34-AC-1

CONNECTICUT RIVER BASIN
1998 WATER QUALITY ASSESSMENT REPORT

Connecticut River looking upstream of the Holyoke Dam, South Hadley/Holyoke, MA

COMMONWEALTH OF MASSACHUSETTS
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CONNECTICUT RIVER BASIN

1998 WATER QUALITY ASSESSMENT REPORT

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  - Riverways Program
- Department of Environmental Management (DEM)

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- Environmental Protection Agency (EPA)
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  - National Water-Quality Assessment Program (NAWQA)
  - Water Resources Division

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- Pioneer Valley Planning Commission (PVPC)
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Cover photo credit: John O'Leary, EOEA Connecticut River Watershed Team Leader

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LIST OF ACRONYMS

7Q10	seven day ten year low flow
ACOE	Army Corps of Engineers
ACEC	Areas of Critical Concern Environmental Concern
BOD	Benthic Oxygen Demand
BRP	Bureau of Resource Protection
BWSC	Bureau of Waste Site Cleanup (MA DEP)
CSO	Combined sewer overflow
CWA	Clean Water Act
DDT	Dichlordiphenyltrichloroethane
DEM	Department of Environmental Management
DEP	Department of Environmental Protection
DFWELE	Department of Fisheries, Wildlife, and Environmental Law Enforcement
DFP/EIR	Draft Facility's Plan/Environmental Impact Report
DPH	Department of Public Health
DWM	Division of Watershed Management
DWP	Drinking Water Program
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GIS (MassGis)	Geographic Information System
MGD	Million gallons per day
Mg/L	Milligram per liter
MGY	Million gallons per year
NAWQA	National Water-Quality Assessment
NEIWPCC	New England Interstate Water Pollution Control Commission
NPDES	National Pollutant Discharge Elimination System
ORW	Outstanding Resource Waters
PCB	Polychlorinated biphenols
QA/QC	Quality Assurance/ Quality Control
RBCs	Rotating Biological Contractors
SBR	Sequencing Batch Reactor
SWQS	Massachusetts Surface Water Quality Standards
TIE	Toxicity identification evaluation
TNC	Transient non-community
TOC	Total Organic Carbon
TSS	Total Suspended Solids
USEPANERL	United States Environmental Protection Agency New England Regional Laboratory
USGS	United States Geological Survey
WBS	Water Body System
WMA	Water Management Act
WPCD	Water Pollution Control District
WPCF	Water Pollution Control Facility
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant

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EXECUTIVE SUMMARY
CONNECTICUT RIVER BASIN 1998 WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters in the state shall be protected. The assessment of current water quality conditions is a key step in the successful implementation of the Watershed Approach. This critical phase provides an assessment of whether or not the designated uses are being met (support, partial support, non-support) or are not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process. The state is required by EPA to report on the status of water quality under the Performance Partnership Agreement (PPA) and every two years as part of Section 305(b) of the Clean Water Act (CWA).

This report presents a summary of current water quality data/information as it relates to assessing the status of the State's designated uses for 27 rivers in the Connecticut River Basin: the mainstem Connecticut River (five segments) and 26 tributaries including Lampson, Bachelor, Temple, Manhan (two segments), Long Plain, Potash, Brickyard, White, Wilton, Tripple, Moose, Broad, Stony, Cooley, Longmeadow, Raspberry and Weston brooks, the Sawmill, Fort and Scantic rivers, four Mill rivers (Hatfield, Hadley, Northampton, and Springfield), the Mill River Diversion, and one unnamed tributary. These data represent approximately 14% (26 of 183) of the named rivers in the Connecticut Basin and about 44% (237.95 of 583) of the river miles. Detailed information for the 32 individual river segments totaling 237.95 river miles is presented for the following designated uses: *Aquatic Life, Fish Consumption, Primary* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics*. The report also presents a similar summary of current information for 47 lakes totaling (2770 acres) in the Connecticut River Basin. It is important to note, however, that not all waters are assessed; these waters, many small and/or unnamed lakes and rivers, are currently unassessed.

CONNECTICUT RIVER BASIN - RIVERS

AQUATIC LIFE USE – RIVERS

The *Aquatic Life Use* is supported when suitable habitat (including water quality) is available for sustaining a native, naturally diverse, community of aquatic flora and fauna. Impairment of the *Aquatic Life Use* (non-support or partial support) may result from anthropogenic stressors that include point and/or nonpoint source(s) of pollution and hydrologic modification. The current status of the *Aquatic Life Use* in the Connecticut River Basin is as follows:

Aquatic Life Use Summary – Rivers

- 53.1 river miles support
- 15.1 river miles partial support
- 2.3 river miles non-support
- 167.45 river miles not assessed

Only two rivers, the mainstem Connecticut River (45.9 of the 67.5 miles) and the Mill River-Hatfield were assessed for the *Aquatic Life Use*. This use was supported for the entire length (24.6 miles) of the Mill River-Hatfield. The *Aquatic Life Use* along the upper mainstem Connecticut River (17.4 miles) is impaired by habitat and flow alteration related to hydromodification (Figure 1). Along this reach of the mainstem, the NH/VT state line to the Turners Falls Dam, Gill/Montague, the *Aquatic Life Use* is assessed as partial support. Downstream from the dam, a 2.3 mile reach of the river is rendered virtually dry for portions of the year because flow is diverted into the Northeast Utility's power canal. This 2.3 mile reach is assessed as non support for the *Aquatic Life Use*. The 28.5 mile reach of the mainstem Connecticut River between its confluence with the Deerfield River and the Mt. Tom Power Station was assessed as supporting the *Aquatic Life Use*. Downstream from this station to the Connecticut state line (lower 21.6 miles), the use was not assessed (too little data to evaluate effects of multiple CSOs and power plants on aquatic life).

The effects of hydromodification resulting from operations of FERC Licensees should be minimized to the extent possible since they are known to contribute to streambank erosion although other factors

(recreation, agricultural activities, natural) also contribute to the problem. Streambank stabilization projects have been initiated in selected areas; however it is too early to evaluate their long-term success.

FISH CONSUMPTION USE - RIVERS

The *Fish Consumption Use* is supported when there are no pollutants present that result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list (1999) of Fish Consumption Advisories issued by the Massachusetts Department of Public Health (MA DPH). This list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in these waters. In 1994, MA DPH also issued a statewide "Interim Freshwater Fish Consumption Advisory" for mercury. This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The MA DPH interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide interim advisory, however, no fresh waters can be assessed as supporting the *Fish Consumption Use,* therefore they remain not assessed. The status of the *Fish Consumption Use* in the Connecticut River Basin is as follows:

Fish Consumption Use Summary – Rivers

- 67.5 river miles non-support
- 170.45 river miles not assessed

Based on the DPH Fish Consumption Advisory for the mainstem Connecticut River, the *Fish Consumption Use* is assessed as non support for the Connecticut's entire 67.5 length in Massachusetts (Figure 2). Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. This project is currently being managed by the New England Interstate Water Pollution Control Commission (NEIWPCC) and the United States Environmental Protection Agency New England Regional Laboratory (US EPA NERL). A summary of this project and its study objectives are presented in Appendix B of this report.

RECREATIONAL USES - RIVERS

The *Primary Contact Recreational Use* is supported when conditions are suitable (low fecal coliform bacteria densities) for any recreation or other water activity during which there is prolonged and intimate contact with the water with a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreation or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

The status of the *Primary* and *Secondary Contact Recreational Uses* in the Connecticut River Basin are as follows:

Primary Contact Use Summary – Rivers

- 15.9 river miles ~~partial~~ non support
- 222.05 river miles not assessed

Secondary Contact Use Summary – Rivers

- 15.9 river miles ~~non-~~ partial support
- 222.05 river miles not assessed

The *Primary* and *Secondary Contact Recreational Use*s are assessed for only one segment in the Connecticut River Basin. Multiple combined sewer overflows (CSOs) currently discharge to the Connecticut River between the Holyoke Dam, Holyoke/South Hadley and the Connecticut state line, Longmeadow/Agawam. The large volume and number of CSOs contributing pathogens in untreated combined sewage to this segment of the Connecticut River impairs the *Primary Contact Recreational Use* for the entire 15.9 miles. The *Secondary Contact Recreational Use* is partially supported for this segment (15.9 miles) as a result of the CSO discharges.

The three major CSO permittees, the Cities of Springfield, Chicopee, and Holyoke, are in the process of CSO facilities planning which will allow the communities to collaborate on a receiving water quality modeling project (filing is expected in late 2001 or early 2002). The receiving water model, which was developed for the Springfield plan, is being expanded to include the regional area from the Holyoke CSOs (upstream of the Holyoke Dam) south to the CT line and will allow for an improved understanding of the collective impacts of regional CSO abatement strategies. Although there are outstanding technical and affordability issues with all three of the CSO communities, these will be resolved through further planning work, through the Massachusetts Environmental Policy Act process, and further regulatory meetings/negotiations. Holyoke, Springfield, and Chicopee will be also be required to implement "9 Minimum Controls" as a condition of their new National Pollutant Discharge Elimination System permits as well as to develop a long-range control plan to address abatement of impacts related to CSOs (Hogan 2000).

AESTHETICS USE - RIVERS

The *Aesthetics Use* is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The status of the *Aesthetics Use* in the Connecticut River Basin is as follows:

Aesthetics Use Summary – Rivers

- 24.6 river miles support
- 213.35 river miles not assessed

The *Aesthetics Use* is assessed in only one stream in the Connecticut River Basin, the Mill River-Hatfield (support 24.6 miles).

SUMMARY - RIVERS

Total PCB in whole fish from the mainstem Connecticut River exceeded the National Academy of Sciences and National Academy of Engineers (NAS/NAE) guidelines for the protection of fish-eating wildlife (Coles 1998). While this dataset is too limited to assess the *Aquatic Life Use*, PCB contamination is of concern and warrants further investigation.

The evaluation of current water quality conditions in the Connecticut River Basin rivers has also revealed the need for the following:

- Additional monitoring (i.e., fecal coliform bacteria sampling to assess the *Primary* and *Secondary Contact Recreational* uses, impact evaluations of thermal discharges),
- Implementation of CSO abatement,
- Minimize streamflow fluctuations to reduce "anthropogenically" induced erosion resulting from hydropower facility operations,
- Post-implementation monitoring to assess the effectiveness of streambank stabilization projects,
- Continue to improve minimum flow releases into the "by-passed" reach of the Connecticut River at the Turner's Falls Dam (diversion to the Northeast Utility's power canal).

MA DEP and EPA are currently reissuing the municipal NPDES permits in the Connecticut River Basin. Emphasis will be placed on CSO control, compliance with secondary treatment requirements, and an initial evaluation of nutrient loading to the system (addressing the far-field nutrient loading to Long Island Sound). Additionally, many of the municipalities will be required to obtain a Phase 2 storm water permit to reduce impacts of storm water to the river by the development of Best Management Practices, elimination of cross connections and through significant public education.

CONNECTICUT RIVER BASIN - LAKES

Overall use support status and trophic status of the lakes, ponds and impoundments (the term "lakes" will hereafter be used to include all) surveyed/assessed in the Connecticut River Basin are presented in

Tables 1 and 2, respectively. These data represent approximately ~~38~~ 41% (~~47~~ 51of 123) of the lakes/ponds in the Connecticut Basin and about ~~83~~ 84% (~~2,770~~ 2,803 of 3,342) of the acreage. It should be noted that lakes or portions of lakes were listed as not assessed when indicators were not readily observable. With this approach, the assessment of lakes in the Connecticut River Basin is limited to a "best case" picture (i.e., only the most obvious impairments are reported). Potentially more of the lake acreage would be listed as impaired or in a more enriched trophic status if additional variables were measured and more criteria assessed. A total of 138 acres of lakes (representing two lakes, Porter Lake and White Reservoir) are “not attainable”.

AQUATIC LIFE USE - LAKES

Despite the "best case" scenario that is favored by the Connecticut River Basin lake assessment approach, ~~49~~ 45% of the lakes showed severe (eutrophic or hypereutrophic) symptoms of succession. Presumably additional testing of dissolved oxygen, chlorophyll, and/or nutrients would corroborate that trophic status conditions are this advanced.

Seven non-native, aquatic plant species (Eurasian water milfoil, variable milfoil, European naiad, American lotus, curly leaf pondweed, fanwort, and water chestnut) were found in lakes of the Connecticut River Basin. These plants are particularly invasive species that reproduce vegetatively so they may spread downstream or be transported mechanically between lakes.

Two non-native, wetland plant species were observed in Connecticut River Basin lakes (Reed grass and Purple loosestrife). Reed grass was identified in two lakes, Tighe Carmody Reservoir, Southampton and Robert’s Meadow Reservoir, Northampton. Purple loosestrife was identified in 11 lakes including: Bray Lake, Holyoke; Forge Pond, Granby; Loon Pond, Springfield; Lower Pond, South Hadley; Mill Pond, Springfield; Noonan Cove, Springfield; Northfield Mountain Reservoir, Erving; Porter Lake, Springfield; Porter Lake West, Springfield; Watershops Pond, Springfield; and Whiting Street Reservoir, Holyoke.

FISH CONSUMPTION USE – LAKES

A fish consumption advisory for the Connecticut River was issued because of PCB contamination. The current advisory recommends Connecticut River recommends that “children under 12 years of age, pregnant women, and nursing mothers should not consume any fish from the Connecticut River (all towns between Northfield and Longmeadow) and the general public should not consume channel catfish, white catfish, American eel or yellow perch (all towns between Northfield and Longmeadow) because of PCB contamination (MA DPH 1999). Because of this advisory, Log Pond and Barton’s coves, embayments of the Connecticut River totaling 248 acres, do not support the *Fish Consumption Use*.

It should also be noted that in 1994, MA DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury. This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. Because the statewide interim advisory encompasses all freshwater in Massachusetts, none of the lakes can be assessed as supporting the *Fish Consumption Use,* therefore they remain not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS - LAKES

Three criteria, macrophyte cover, transparency, and biocommunity modifications were used to assess the recreational and aesthetics uses. Due to the focus of the surveys conducted, the major cause of impairment was aquatic plants (either noxious-native or non-native). Turbidity, flow alteration, and objectionable taste/odor were also occasionally identified as causes of impairment. Because of the lack of fecal coliform bacteria data, 74% of the lake acreage was not assessed for the *Primary Contact Recreational Use*, nor was fecal coliform bacteria listed as a cause of impairment.

SUMMARY – LAKES

Despite the "best case" scenario that is favored by the Connecticut River Basin lake assessment approach, ~~49~~ 45% of the lakes showed severe (eutrophic or hypereutrophic) symptoms of succession (Table 2). Presumably additional testing of dissolved oxygen, chlorophyll, and/or nutrients would corroborate that trophic status conditions are this advanced.

Table 1. Connecticut River Basin Lakes Use Support Summary (In Acres).

USE	SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED	NOT ATTAINABLE
Aquatic Life	0	759.9	0	~~1872.5~~ 1905.5	138
Fish Consumption*	0	0	248	~~2384.4~~ 2417.4	138
Primary Contact	0	399.9	183	~~2049.5~~ 2082.5	138
Secondary Contact	1994.8	399.9	183	~~54.7~~ 87.7	138
Aesthetics	1994.8	399.9	183	~~54.7~~ 87.7	138

* NOTE: In 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury. This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* will not be assessed as support.

Table 2. Connecticut River Basin Lakes Trophic Status Summary surveyed in Summer, 1998.

TROPHIC STATUS	NUMBER OF LAKES	ACRES
Oligotrophic	0	0
Mesotrophic	0	0
Eutrophic	19	515.8
Hypereutrophic	4	104.5
Undetermined/ Not Attainable	~~24~~ 28	~~2150.1~~ 2183.1
Total	~~47~~ 51	~~2770.4~~ 2803.4

The evaluation of current water quality conditions in the Connecticut River Basin lakes has revealed the need for the following:

- Additional monitoring (fecal coliform bacteria sampling and secchi disk depth measurements to assess the *Primary Contact Recreational Use* and water chemistry data including dissolved oxygen profiles to assess the *Aquatic Life Use*).
- Continue to control the spread and growth of non-native aquatic vegetation, particularly *Trapa natans*.
- Continue to implement recommendations from the lake Diagnostic/Feasibility Studies.

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Connecticut River Basin
Aquatic Life Use Assessment Summary

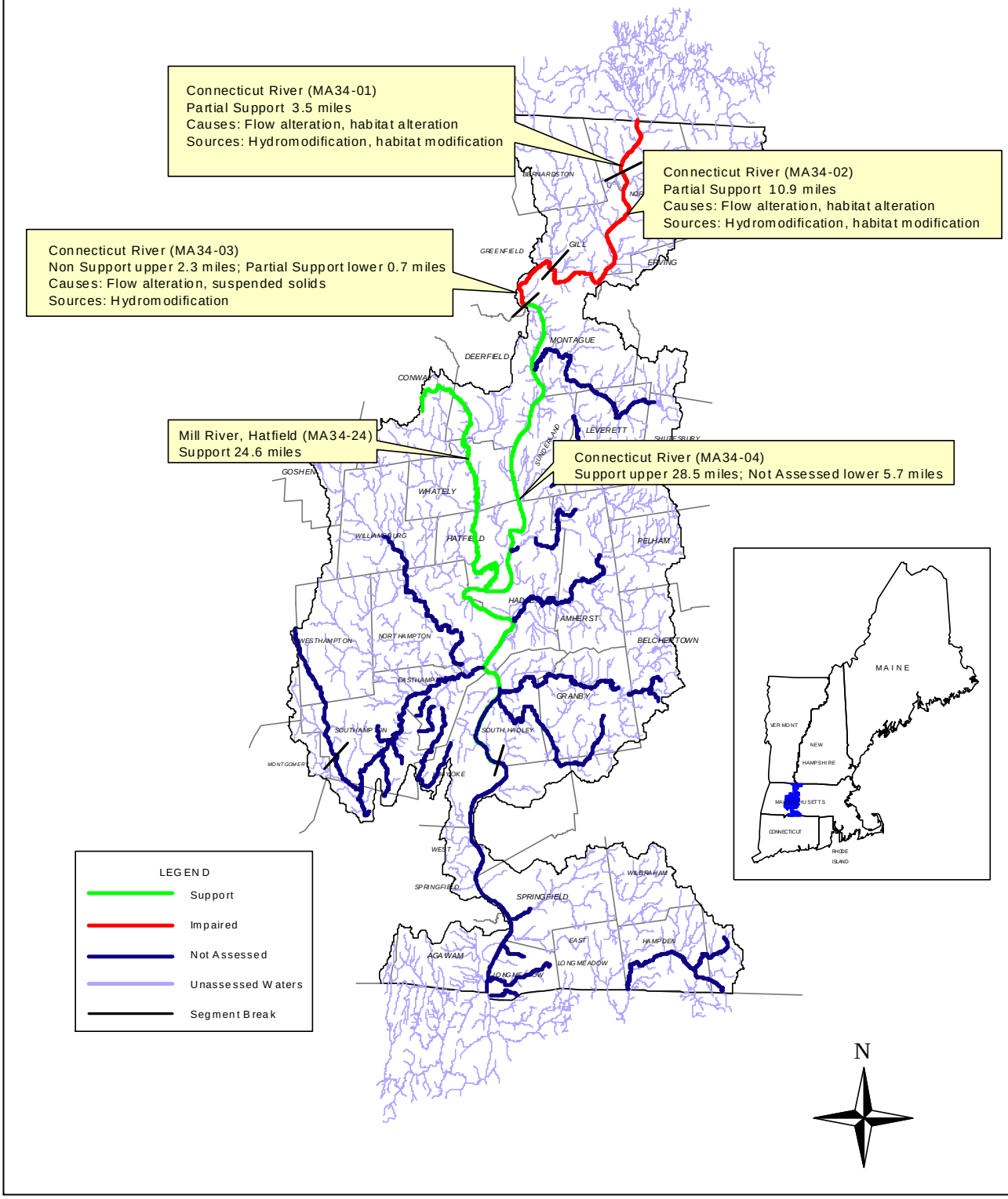

Figure 1. Connecticut River Basin Aquatic Life Assessment Summary - Rivers

Connecticut River Basin
Fish Consumption Use Assessment Summary

MA DPH Fish Consumption Advisory for the Connecticut River (all towns between Northfield and Longmeadow): Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB

NOTE: In 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury. This precautionary measure is aimed at pregnant women only; the general public is not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts; unless a specific advisory exists for a waterbody, the Fish Consumption Use is not assessed.

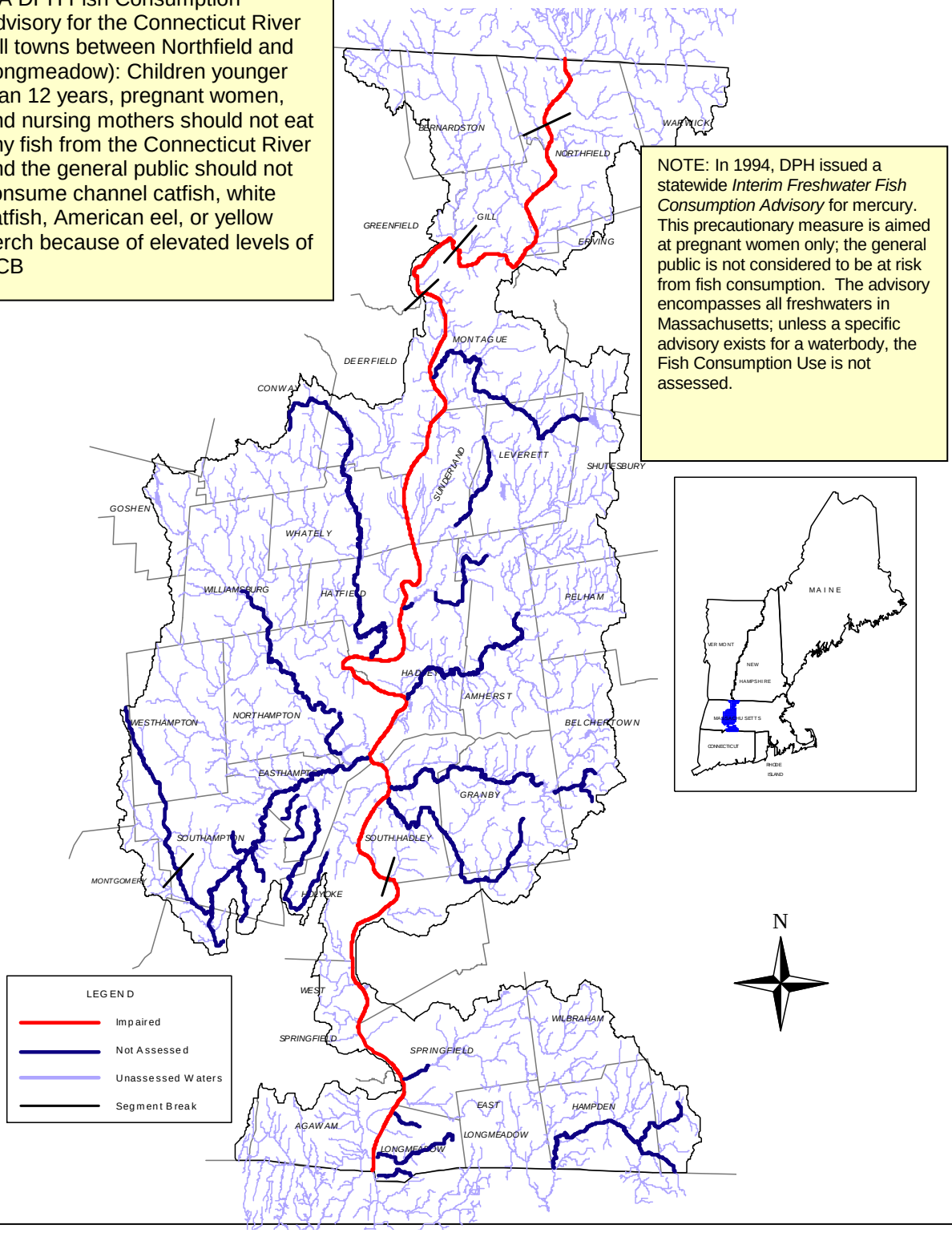

Figure 2. Connecticut River Basin Fish Consumption Use Assessment Summary - Rivers

INTRODUCTION

The Massachusetts Watershed Initiative is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the basin's natural resources can be achieved. Implementation of this initiative is underway in a process known as the "Watershed Approach". The "Five-year Cycle" of the "Watershed Approach", as illustrated in Figure 3, provides the management structure to carry out the mission. Information researched and developed in the first three years of the "Five-year Cycle" was utilized by the Massachusetts Department of Environmental Protection (MA DEP) to report on water quality conditions in the Massachusetts portion of the Connecticut River Basin. This report fulfills part of MA DEP's mandate under the Clean Water Act (CWA).

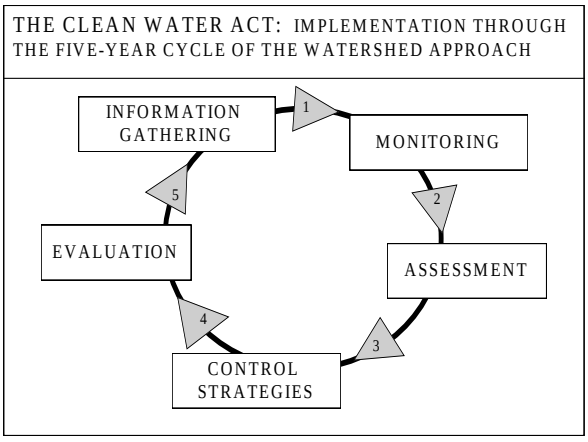

Figure 3. Clean Water Act Implementation Cycle

The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this goal, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. EPA and the states are responsible for implementation of the CWA mandates. Under Section 305(b) of the CWA, MA DEP must submit a statewide report every two years to the EPA, which summarizes the status of water quality in the Commonwealth. The most recent 305(b) Report is the *Commonwealth of Massachusetts Summary of Water Quality 2000* (MA DEP 2000a). The statewide 305(b) Report is based on the compilation of current assessment information for the Commonwealth's 27 watersheds. Assessments made for 305(b) reporting utilize data from a variety of sources. The 305(b) Report provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level.

The Connecticut River Basin 1998 Water Quality Assessment Report has been developed by MA DEP's Division of Watershed Management (DWM) to provide data and detailed assessment information for selected segments (a specifically defined reach of river or an individual lake) in the Connecticut River Basin. This assessment information is maintained by MA DEP in the Water Body System (WBS) database, which is updated every two years and used to generate the state's 305(b) Report. The assessments contained in this report will be submitted to EPA in the 2002 305(b) Report. Described in the following section (Assessment Methodology) are the standardized assessment methodologies for the interpretation of instream biological, habitat, physical/chemical, toxicity, and other data.

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). These regulations undergo public review every three years. These surface waters are segmented and each segment is assigned to one of the six classes described below:

Inland Water Classes

1. ***Class A*** – *These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life* and *wildlife,*

and *suitable for primary* and *secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW's) under 314 CMR 4.04(3).*

2. ***Class B*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife,* and *for primary* and *secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation* and *other agricultural uses* and *for compatible industrial cooling* and *process uses. These waters shall have consistently good aesthetic value.*

3. ***Class C*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife,* and *for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking* and *for compatible industrial cooling* and *process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. ***Class SA*** *– These waters are designated as an excellent habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*

5. ***Class SB*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*

6. ***Class SC*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife* and *for secondary contact recreation. They shall also be suitable for certain industrial cooling* and *process uses. These waters shall have good aesthetic value.*

The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the States report on waterbodies within the context of meeting their designated uses (described above in each class). Each class is identified by the most sensitive, and therefore governing, water uses to be achieved and protected. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics*. Three subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life such as trout), Warm Water Fishery (waters which are not capable of sustaining a year-round population of cold water aquatic life), and Marine Fishery (suitable for sustaining marine flora and fauna).

A summary of the state water quality standards (Table 3) prescribes minimum water quality criteria to sustain the designated uses. Furthermore these standards describe the hydrological conditions at which water quality criteria must be met (MA DEP 1996). In rivers and streams, the lowest flow conditions at and above which criteria must be met is the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which criteria must be met is the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow which has been agreed upon. In coastal and marine waters and for lakes and ponds the most severe hydrological condition is determined by MA DEP on a case by case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA establish a Quality System to support the development, review, approval, implementation, and assessment of data collection operations. To this end, MA DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or

compiled by the Agency are of known and documented quality and are suitable for their intended use. For external sources of information, MA DEP requires the following: 1) an appropriate *Quality Assurance Project Plan* including a QA/QC plan, 2) use of a state certified lab (certified in the applicable analysis), 3) data management QA/QC be described, and 4) the information be documented in a citable report.

EPA provides guidelines to the states for making their use support determinations (EPA 1997). The determination of whether or not a waterbody can be assessed to determine if it supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered "historical" and used for descriptive purposes, they can be utilized in the use support determination providing they are known to reflect the current conditions. While the water quality standards (Table 3) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection* and *Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton).

Each designated use within a given segment is individually assessed as 1*)* ***support***, 2) ***partial support***, or 3) ***non- support***. The term ***threatened*** is used when the use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data/information exists or no reliable data are available the use is ***not assessed***. In this report, however, if there is some indication that water quality impairment may exist based on any given variable, it is identified with an "Alert Status". It is important to note, however, that not all waters are assessed. Many small and/or unnamed lakes, rivers and estuaries are currently ***unassessed***; the status of their designated uses has never been reported to EPA in the state's 305(b) Report nor is information on these waters maintained in the WBS database.

Table 3. Summary of Massachusetts Surface Water Quality Standards (MADEP 1996). *Note*: *Italics are direct quotations.*

Dissolved Oxygen	Class A, BCWF*, SA : ≥ 6.0 mg/L and ≥ 75% saturation unless background conditions are lower Class BWWF**, SB: ≥ 5.0 mg/L and ≥ 60% saturation unless background conditions are lower Class C: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge Class SC: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge
Temperature	Class A: ≤ 68°F (20°C) and Δ 1.5°F (0.8°C) for Cold Water and ≤ 83°F (28.3°C) and Δ 1.5°F (0.8°C) for Warm Water Class BCWF: ≤ 68°F (20°C) and Δ3°F (1.7°C) due to a discharge Class BWWF: ≤ 83°F (28.3°C) and Δ3°F (1.7°C) in lakes, Δ5°F (2.8°C) in rivers Class C, SC: ≤85°F (29.4°C) nor Δ5°F (2.8°C) due to a discharge Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) between July through September and Δ 4.0°F (2.2°C) between October through June
pH	Class A, BCWF, BWWF: 6.5 – 8.3 and Δ0.5 outside the background range. Class C: 6.5 – 9.0 and Δ1.0 outside the naturally occurring range. Class SA, SB: 6.5 – 8.5 and Δ0.2 outside the normally occurring range. Class SC: 6.5 – 9.0 and Δ0.5 outside the naturally occurring range.
Fecal Coliform Bacteria	Class A: an arithmetic mean of < 20 organisms /100 ml in any representative set of samples and < 10% of the samples > 100 organisms/100 ml. Class B: a geometric mean of < 200 organisms /100 ml in any representative set of samples and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the MA DEP.) Class C: a geometric mean of < 1000 organisms /100ml, and < 10% of the samples > 2000 organisms/100 ml. Class SA: approved Open Shellfish Areas: a geometric mean (MPN method) of < 14 organisms/100 ml and < 10% of the samples > 43 organisms/100 ml (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SB: approved Restricted Shellfish Areas: < a fecal coliform median or geometric mean (MPN method) of 88 organisms/100 ml and < 10% of the samples > 260 organisms /100 ml (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the MA DEP.) Class SC: < a geometric mean of 1000 organisms/100 ml and < 10% of the samples > 2000 organisms/100ml.
Solids	All Classes: *These waters shall be free from floating, suspended,* and *settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color* and *turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil & Grease	Class A, SA: *Waters shall be free from oil* and *grease, petrochemicals* and *other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil* and *grease* and *petrochemicals.* Class B, C,SB, SC: *Waters shall be free from oil* and *grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A, SA: *None other than of natural origin.* Class B, C,SB, SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants ~	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife… The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.*
Nutrients	*Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.*

*Class BCWF = Class B Cold Water Fishery, ** Class BWWF = Class B Warm Water Fishery, Δ criterion (referring to a change from ambient) is applied to the effects of a permitted discharge. ~ USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996):

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards for freshwater bodies; *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life such as trout, *Warm Water Fishery* - waters which are not capable of sustaining a year-round population of cold water aquatic life, and *Marine Fishery* - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- DRINKING WATER - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

Other restrictions which denote specific subcategories of use assigned to the segment that may affect the application of criteria or specific antidegradation provision of 314 CMR 4.00, which are specified along segments of the Connecticut River, include:

- CSO – These waters are identified as impacted by the discharge of combined sewer overflows in the classification tables in 314 CMR 4.06(3). Overflow events may be allowed by the permitting authority without a variance or partial use designation where the provisions 314 CMR 4.06(1)(d)10 are met. The waterbody may be subject to short-term impairment of swimming or other recreational uses, but support these uses through most of their annual period of use; and the aquatic life community may suffer some adverse impact yet is still generally viable).

[Note: The State Water Quality Standards (SWQS) have "CSO" listed where CSO impacts occur. However, this is only a notation and <u>does not</u> have regulatory significance unless all of the provisions of 314 CMR 4.06 (1) (d) 10. have been met (Facilities Plan Approval, Use Attainability Analysis, etc.) and MA DEP makes a formal administrative determination after a public hearing and MEPA filing that a B(CSO) designation is supported and appropriate (Brander 2000).]

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MA DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aquatic Life Use*:

Variable (# indicates reference)	***Support***—Data available clearly indicates support. Minor excursions from chemical criteria (Table 3) may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** -- Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** -- There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgement (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered Streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Non-native plant species present, but not dominant, BPJ	Non-native plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
DO (3, 6)	Criteria (Table 3)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 3)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) [1]	Criteria (Table 3), [1]	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Total Phosphorus(4)	Table 3, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4) Chlorine (3, 6)	Criteria (Table 3) 0.254 mg/L NH_3-N [2] 0.011 mg/L TRC	BPJ	Criterion is exceed in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5)	≤ L-EL[3], Low Effect Level	One pollutant between L-EL and S-EL	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility is not in compliance with their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 μg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 μg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1]maximum daily mean T in a month (min 6 measurements evenly distributed over 24-hours) <criterion, [2]Ammonia levels for pH of 9.0, actual "criterion" varies with pH and is evaluated case-by-case. [3]For the purpose of this report, the S-EL for total PCB in sediment (which varies with TOC content) with 1% TOC is 5.3 PPM while a sediment sample with 10% TOC is 53ppm.

Note: The National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500μg/kg wet weight (PPB, not lipid-normalized). PCB data (tissue) in this report are presented in μg/kg wet weight (PPB) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (DPH), Bureau of Environmental Health Assessment (MA DPH 1999). The DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in these waters. In 1994, DPH also issued a statewide "Interim Freshwater Fish Consumption Advisory" for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. DPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide interim advisory, however, no fresh waters can be assessed as supporting the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

Variable (# indicates reference)	***Support*** —No restrictions or bans in effect	***Partial Support*** – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	***Non-Support*** – A "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species; or there is a commercial fishing ban in effect
DPH Fish Consumption Advisory List (8)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on DPH Fish Consumption Advisory List *

DRINKING WATER USE

The Drinking Water Use denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). This use is assessed by MA DEP's Drinking Water Program (DWP). Below is EPA's guidance used to assess the status (support, partial support, non-support) of the drinking water use.

Variable (# indicates reference)	***Support***-- No closures or advisories (no contaminants with confirmed exceedences of MCLs, conventional treatment is adequate to maintain the supply).	***Partial Support*** – Is one or more advisories or more than conventional treatment is required	***Non-Support*** – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	Reported by DWP	Reported by DWP	Reported by DWP

PRIMARY CONTACT RECREATIONAL USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Use*.

Variable (# indicates reference)	***Support***-- Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** –Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** –Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9) *	Criteria met OR Dry Weather Guidance <5 samples--≤400/100 ml maximum Wet Weather Guidance Dry weather samples meet and wet samples ≤2000/100 ml	Guidance exceeded in 11-25% of the samples OR Wet Weather Dry weather samples meet and wet samples >2000/100 ml	Guidance exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	Δ 5 NTU (due to a discharge) exceeded in <10 % of the measurements	Guidance exceeded in 11-25% of the measurements	Guidance exceeded in >25% of the measurements
Secchi disk depth (10) **	Lakes - ≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)**	No nuisance organisms that render the water aesthetically objectionable or unusable; Lakes – cover of macrophytes < 50% of lake area at maximum extent of growth.	Lakes – cover of macrophytes 50-75% of lake area at their maximum extent of growth.	Lakes – cover of macrophytes >75% of lake area at their maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal Coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Bacteria data results (fecal coliform) are interpreted according to whether they represent dry weather or wet weather (stormwater runoff) conditions. Accordingly, it is important to interpret the amount of precipitation received in the study region immediately prior to sampling and streamflow conditions.

** Lakes exhibiting impairment of the primary contact recreation use (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) are assessed as either *partial* or *non-support*. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance this use is *not assessed*.

SECONDARY CONTACT RECREATIONAL USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Secondary Contact Use*.

Variable (# indicates reference)	***Support***-- Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** –Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** –Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4) *	Dry Weather Guidance <5 samples--≤2000/100 ml maximum >5 samples--≤1000/100 ml geometric mean ≤ 10% samples ≥2000/100 ml Wet Weather Guidance Dry weather samples meet and wet samples ≤4000/100 ml	Wet Weather Guidance Dry weather samples meet and wet samples >4000/100 ml	Criteria exceeded in dry weather
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4) **	No nuisance organisms that render the water aesthetically objectionable or unusable; Lakes – cover of macrophytes < 50% of lake area at their maximum extent of growth.	Macrophyte cover is between 50 – 75%	Macrophyte cover exceeds 75% of the lake area.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal Coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Bacteria data results (fecal coliform) are interpreted according to whether they represent dry weather or wet weather (stormwater runoff) conditions. Accordingly it is important to interpret the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions.

** In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

For the *Primary* and *Secondary Contact Recreational* uses the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria results,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), (Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.)
3. Calculate the % of sample results exceeding 400 cfu/100 mLs,
4. Determine if the samples were collected during wet or dry weather conditions (review precipitation and streamflow data),
   Dry weather can be defined as: No/trace antecedent (to the sampling event) precipitation that causes more than a slight increase in streamflow.
   Wet weather can be defined as: Precipitation antecedent to the sampling event that results in a marked increase in streamflow.
5. Apply the following to interpret dry weather data:
   ≤10% of the samples exceed criteria (step 2 and 3, above) assessed as Support,
   11-25% of the samples exceed criteria (step 2 and 3, above) assessed as Partial Support,
   >25% of the samples exceed criteria (step 2 and 3, above) assessed as Non-Support.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aesthetics Use*.

Variable (# indicates reference)	***Support*** – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. objectionable odor, color, taste or turbidity, or nuisance aquatic life	***Partial Support*** **-** Objectionable conditions neither frequent nor prolonged	***Non-Support*** – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation

* For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

References

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CONNECTICUT RIVER BASIN

DESCRIPTION

The Connecticut River and its tributaries constitute the largest river basin in New England. It has a maximum length of approximately 280 miles, a maximum width of about 60 miles and a total drainage area of approximately 11,250 square miles. From its origin in the Connecticut Lakes Region near the Canadian border, the 410 mile Connecticut River flows southward to form the boundary between New Hampshire and Vermont. It then flows through Massachusetts and Connecticut to the Long Island Sound. The river provides 70-80% of the freshwater entering the sound and is an integral part of its ecosystem (NEIWPCC 1997). The Connecticut River traverses approximately 67 river miles and drains approximately 2,726 square miles within Massachusetts.

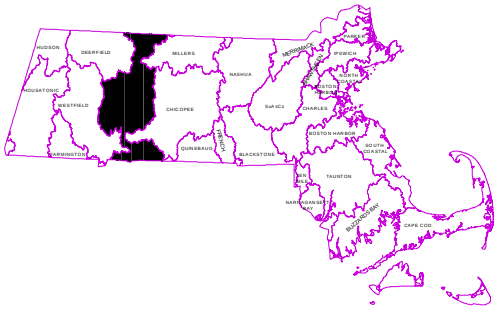

Figure 4. Location of Connecticut River Basin.

The river elevation change in Massachusetts is approximately 150 feet, a mean gradient of approximately two feet per river mile. The basin is bounded to the west by the Berkshire Mountains, which rise to an elevation above 3000 feet and to the east by the Central Massachusetts Plateau that rises to an approximate maximum elevation of 2000 feet.

Based upon the Massachusetts Water Resources Commission's delineation, the Connecticut River Basin drains approximately 670 square miles (exclusive of the Deerfield, Millers, Westfield and Chicopee subbasins). There are a total of 183 named rivers in the basin which flow approximately 538 river miles (Halliwell *et al.* 1982). The communities of Agawam, Amherst, Ashfield, Belchertown, Bernardston, Chesterfield, Chicopee, Conway, Deerfield, East Longmeadow, Easthampton, Erving, Gill, Goshen, Granby, Greenfield, Hadley, Hampden, Hatfield, Holyoke, Huntington, Leverett, Leydon, Longmeadow, Ludlow, Monson, Montague, Montgomery, Northampton, Northfield, Pelham, Royalston, Shutesbury, South Hadley, Southampton, Southwick, Springfield, Sunderland, Warwick, Wendell, West Springfield, Westfield, Westhampton, Whately, Wilbraham, and Williamsburg lie wholly or in part within the watershed boundaries. Major tributaries discharging to the Connecticut River within Massachusetts, include the Millers, Deerfield, Chicopee and Westfield rivers.

The Connecticut River Basin (Figure 4) is located in western Massachusetts. It is bordered by the Deerfield River Basin to the northwest, the Westfield River Basin to the southwest, the Millers River Basin to the northeast and by the Chicopee River Basin to the southeast. The Connecticut River enters Massachusetts in the town of Northfield and flows south/southwest through the state for approximately 67 river miles exiting Massachusetts at the towns of Longmeadow and Agawam.

A total of 123 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned PALIS code numbers (Pond and Lake Information System, Ackerman 1989) in the Connecticut River Basin. Less than half of these (48) are greater than or equal to 10 acres in size. Only 24 lakes in this watershed are recognized officially as Great Ponds.

CLASSIFICATION

Consistent with the National Goal Uses of “fishable and swimmable waters”, the classification of waters in the Connecticut River Basin according to the SWQS, include the following (MA DEP 1996):

Class A Public Water Supplies in the Connecticut River Basin:

- Atkins Reservoir, Source to outlet in Shutesbury and those tributaries thereto

- Hawley Reservoir, Source to outlet in Pelham and those tributaries thereto
- Hill Reservoir, Source to outlet in Pelham and those tributaries thereto
- Reservoir (Running Gutter Brook Reservoir), Source to outlet in Hatfield and those tributaries thereto
- White Reservoir, Source to outlet in Southampton and those tributaries thereto
- Tighe Carmody Reservoir (Manhan Reservoir), Source to outlet in Southampton and those tributaries thereto
- Whiting Street Reservoir, Source to outlet in Holyoke and those tributaries thereto
- Green Pond, Source to outlet in Montague and those tributaries thereto
- Lake Pleasant, Source to outlet in Montague and those tributaries thereto
- Roberts Meadow Reservoir, Source to outlet in Northampton and those tributaries thereto
- Mt. Street Reservoir, Source to outlet in Williamsburg and those tributaries thereto
- Unnamed Reservoir (Northampton Reservoir [New], Ryans Reservoir), Source to outlet in Whately and those tributaries thereto
- Northampton Reservoir [Old] (West Whately Reservoir), Source to outlet in Whately and those tributaries thereto
- Reservoir (Louisiana Brook Reservoir, Grandin Reservoir, Upper Reservoir), Source to outlet in Northfield and those tributaries thereto
- Lithia Springs Reservoir, Source to outlet in South Hadley and those tributaries thereto
- Reservoir (Mt. Brook Reservoir), Source to outlet in Westhampton and those tributaries thereto
- Unquomonk Reservoir, Source to outlet in Williamsburg and those tributaries thereto
- Unnamed Reservoir (Roaring Brook Reservoir), Reservoir to outlet in Conway and those tributaries thereto

In the Connecticut River Basin, all designated ORWs are associated with the Class A waters (Rojko *et al.* 1995). The designation of ORW is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools and all designated *Class A Public Water Supplies*, and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACEC) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

- No areas in the Connecticut River Basin have been formally designated as ACECs by the Massachusetts Secretary of Environmental Affairs.

Class B Warm Water Fisheries in the Connecticut River Basin:

- Connecticut River, New Hampshire/Vermont/Massachusetts State Line to the Holyoke Dam, Holyoke/South Hadley
- Connecticut River, Holyoke Dam, Holyoke/South Hadley to the Connecticut State Line, Longmeadow/Agawam, (CSO)
- Bachelor Brook, outlet Forge Pond Granby to confluence with Connecticut River, South Hadley
- Weston Brook, from the confluence with Lampson Brook, Belchertown to inlet Forge Pond, Granby
- Lampson Brook, Belchertown WWTP to confluence with Weston Brook

Unlisted waters not otherwise designated in the SWQS are designated *Class B, High Quality Water*. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards (SWQS). The following table identifies waterbodies in the Connecticut River Basin in Massachusetts which are on the 1998 Section 303(d) list of waters (MA DEP 1999a):

Table 4. 1998 303(d) list of impaired waters, Connecticut River Basin (MA DEP 1999a).

1998 303(d) Listed Waterbody		Cause of Impairment
Connecticut River	New Hampshire/Vermont state line to Route 10 bridge, Northfield	priority organics (PCB) and pathogens (fecal coliform bacteria)
	Route 10 bridge, Northfield to Turners Falls Dam, Montague	PCB
	Turners Falls Dam, Montague to confluence with Deerfield River, Greenfield	PCB
	Confluence with Deerfield River, Greenfield to Holyoke Dam, Holyoke	PCB, and fecal coliform bacteria
~~Weston Brook~~ should be Connecticut River	Holyoke Dam, Holyoke to Connecticut state line, Longmeadow/Agawam	PCB, fecal coliform bacteria, and suspended solids
Weston Brook	Headwaters Belchertown to inlet Forge Pond, Granby	unionized ammonia, chlorine, nutrients, organic enrichment/low DO, and fecal coliform bacteria
Lampson Brook	Belchertown State Hospital WWTP to confluence with Weston Brook, Belchertown	unionized ammonia, chlorine, nutrients, and organic enrichment/low DO
Arcadia Lake	Belchertown	nutrients, and noxious aquatic plants
Lake Bray	Holyoke	noxious aquatic plants
Forge Pond	Granby	nutrients and noxious aquatic plants
Ingraham Brook Pond	Granby	noxious aquatic plants
Leverett Pond	Leverett	noxious aquatic plants and turbidity
Loon Pond	Springfield	nutrients and noxious aquatic plants
Metacomet Lake	Belchertown	organic enrichment/low DO
Nashawannuck Pond	Easthampton	nutrients, organic enrichment/low DO, and noxious aquatic plants
Venture Pond	Springfield	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Lake Warner	Hadley	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Watershops Pond	Springfield	noxious aquatic plants
Lake Wyola	Shutesbury	noxious aquatic plants, organic enrichment/low DO, and nutrients
Aldrich Lake*	Granby	noxious aquatic plants
Aldrich Lake*	Granby	noxious aquatic plants
Upper Van Horn Park Pond**	Springfield	Nutrients, noxious aquatic plants

*needs confirmation (additional data connection is necessary to confirm the presence of impairment)
**mistakenly listed as being in the Chicopee River Basin in the 1998 303(d) list

According to the Commonwealth of Massachusetts Summary of Water Quality 1992 Appendix I Basin/Segment Information (MA DEP 1993) the water quality of the entire length of the Connecticut River mainstem in Massachusetts did not support the uses designated for Class B waters. This non-support status was due to the presence of priority organics (in particular, PCBs), and in some areas, pathogens (as measured by fecal coliform bacteria), and suspended solids primarily from urban runoff, combined sewer overflows and unknown sources. Water quality in the tributary streams to the mainstem in most cases supported the uses designated for Class B waters, however many of these streams were characterized as "threatened" due mainly to: nutrients, pesticides, siltation, pathogens, organic enrichment, and thermal modifications. Nonpoint source impacts to tributaries were described by local groups and agencies as being localized and directly related to specific land-use activities occurring within a subwatershed. Sources of these contaminants were identified in all but two tributaries as exclusively nonpoint in origin and included: urban runoff/storm sewers, land development, silvaculture, recreational activities, on-site wastewater treatment systems, and agriculture (MA DEP 1993).

There is a MA DPH fish consumption advisory for the mainstem Connecticut River because of PCB contamination. A summary of the historical information of fish toxics monitoring as well as a synopsis of

current investigations is provided in Appendix B. The most recent MA DPH Fish Consumption Advisory List for the Connecticut River recommends the following (MA DPH 1999):

> Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River (all towns between Northfield and Longmeadow), and
>
> The general public should not consume channel catfish, white catfish, American eel, or yellow perch from the Connecticut River (all towns between Northfield and Longmeadow).

This advisory does not make exception for anadromous fish therefore it is also applicable to them (Beattie 2000).

In 1994, MA DPH also issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* can not be assessed as support.

SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Connecticut River Basin. Within the Massachusetts Department of Environmental Protection (MA DEP) information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, lake synoptic survey data were provided by MA DEP BRP Division of Watershed Management (DWM) Watershed Planning Program (Table 8). Water withdrawal and wastewater discharge permit information was provided by the MA DEP Western Regional Office Connecticut River Watershed Team and the DWM Watershed Permitting Program (Water Management Act, and National Pollutant Discharge Elimination System). [Note: The BRP DWM Drinking Water Program evaluates the status of the *Drinking Water Use* and this information is therefore not provided in this assessment report.] Projects funded through various MA DEP grant and loan programs also provide valuable information that may be used in the water quality assessment report. A summary these projects for the Connecticut River Basin is provided in Appendix A.

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (MA DPH), the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) Division of Fisheries and Wildlife and Riverways programs, and the Department of Environmental Management (DEM). Federal agencies contributing include the EPA and United States Geological Survey (USGS). In addition to state and federal agencies, regional, local, and citizen monitoring groups provide data/information for the watershed management process which may be used to indicate areas of both high and degraded water quality, as well as causes and sources of contamination.

Discussions with regional planning agencies, conservation districts, local officials, and environmental interest groups in the watershed revealed several major nonpoint source related water quality concerns for the Connecticut River mainstem. In the north and central sections of the mainstem of the river, riverbank erosion and siltation were cited as major problems. Urban runoff was identified as the major nonpoint source while combined sewer overflows were the major point source contributor to water quality degradation in the southern reach of the river.

The USGS as part of their National Water-Quality Assessment (NAWQA) Program in the Connecticut, Housatonic, and Thames River Basins Study Unit conducted water quality sampling in the Connecticut River Basin between 1992 and 1995. A summary of their data collection efforts, by study component, is provided in Table 5. Results of these investigations are published in Breault and Harris (1997), Coles (1996 and 1998), Garabedian *et al.* (1998), and Harris (1997). One specific objective of their study was to determine the occurrence and distribution of organochorines in fish tissue along the mainstem Connecticut River (headwaters to mouth). Elevated levels of total PCB in fish at four sampling stations (Charleston, NH, Montague and Longmeadow, MA and Portland, CT) exceeded the NAS/NAE guidelines

for the protection of fish-eating wildlife (Coles 1998). Since this dataset however is limited to only one sample per station, these data were only used to place the *Aquatic Life Use* on "Alert Status".

Table 5. Summary of Data Collection by USGS NAWQA Program in the Connecticut River Basin (Garabedian *et al*. 1998).

STUDY COMPONENT	STUDY OBJECTIVE	BRIEF DESCRIPTION OF SAMPLING EFFORT	FREQUENCY OF SAMPLE COLLECTION AND LOCATION*
Pesticides in Surface Water	Determine the occurrence and distribution of pesticides to surface water from urban, agricultural, and forested settings.	Sample streams during high and low flow conditions for pesticides and (or) nutrients, organic carbon, suspended sediment, and streamflow	Once per site (1992-1994) MC, NH, LM
Contaminants in fish tissue	Determine the presence of organochlorine compounds that can accumulate in fish tissues	Collect eight white sucker and submit composite of eight whole fishes for organic compound analysis	Once per site (1993-1994) MC, NH, LM
Bottom-sediment survey	Determine presence of potentially toxic compounds within the bed sediments of streams and evaluate their potential for adverse biological effects on aquatic organisms	Sample depositional zones of streams for trace elements and hydrophobic organic compounds.	Once per site (1993-1994) MC, NH, LM

* Connecticut River at Montague City (MC), Mill River-Northampton (a tributary of Connecticut River near Oxbow/Manhan River) at Northampton (NH), and Connecticut River near Longmeadow (LM)

A Connecticut River Watershed Restoration 319 Project (Phase I) was conducted by the Franklin Regional Council of Governments and the CRSEC. This project, funded by EPA and MA DEP, began in 1996 and was completed in 1998. The purpose of this project was to reduce erosion to the banks of the Connecticut River through the design and installation of bioengineered bank stabilization. Three sites in Northfield were selected for streambank restoration: Wickey, Crooker, and Shearer. Wickey and Shearer were constructed in the fall/winter of 1996, and planted in the fall to spring of 1996-97. The Crooker site was constructed in the summer of 1997, and planted between the fall of 1997 and the fall of 1998. The Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee (1999) reported the following in *Connecticut River Watershed Restoration Project: S.319 Project 96-03, 1996-1998*:

> Severe bank erosion in the Connecticut River has also been a concern for many years, particularly in the Turners Falls Pool (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999). Numerous studies have been completed to identify the causes of the erosion, assess the condition of the banks, and seek ways to mitigate the damage. A 1979 "Report on Connecticut River Streambank Erosion Study" completed by the Army Corps of Engineers (ACOE) provides a detailed discussion of river hydrology and an analysis of the erosion in the Connecticut River in Massachusetts, New Hampshire and Vermont. The report attempts to identify the causes of erosion and rates the importance of each contribution to the banks of the Connecticut. In addition to natural causes such as shear stress and stage variation, the report identified pool fluctuations and boat waves as contributing factors. Pool fluctuations are named as causing an increase in bank instability on the order of 18% of the shear stress exerted in the bank merely by flowing water. The report also points out the difference in the nature of the erosion caused by wave action, which only works at the level of the water; and the various shear stress forces that work on the full height of the submerged bank, where the maximum shear stress is exerted on the bank below water at about 2/3 of the water's depth. In July of 1991, the ACOE completed a follow-up report on the erosion in the Turners Falls Pool, "General Investigation Study, Connecticut River Streambank Erosion: Connecticut River, Turners Falls Dam to State Line, MA." That study concluded that the riverbank erosion had increased almost threefold since 1979, with approximately one-third of the shoreline undergoing active erosion. In the spring of 1994, the Franklin County Commission convened a group of stakeholders to take up the problem of erosion in the Turners Falls Power Pool.

The Connecticut River Atlantic Salmon Restoration Program began in 1967 when Massachusetts, Connecticut, Vermont, New Hampshire, the U.S. Fish and Wildlife Service, and National Marine Fisheries Service signed a statement of intent to restore anadromous fish to the Connecticut River (USFWS 2000). In 1983, Congress passed the Atlantic Salmon Compact which formed the Connecticut River Atlantic

Salmon Commission. The Silvio O. Conte National Fish and Wildlife Refuge Act of 1991 reaffirmed the importance of conserving, protecting, and enhancing migratory fish populations and habitat, supporting research, and education. The Connecticut River Atlantic Salmon Commission, has set forth six goals to accomplish its mission of restoring and enhancing Atlantic salmon populations in the Connecticut River:

1. manage Atlantic salmon production to produce sea-run Atlantic salmon returns,
2. enhance and maintain the quantity, quality, and accessibility of salmon habitat necessary to support re-established spawning populations,
3. protect Connecticut River Atlantic salmon from exploitation,
4. allocate adult sea-run salmon to maximize benefits to the program,
5. assess program effectiveness by conducting monitoring, evaluation, and research, and by implementing appropriate changes, and
6. to provide the public with information and opportunities to be involved in the restoration program

The stock enhancement aspect of the program involves the release of smolts and fry into the waters of the Connecticut and its tributaries (USFWS 2000). Early in the program, two-year old hatchery reared smolts of Canadian origin were released. In 1983, in an effort to increase the number of smolts released, one-year old smolts were produced. Fry stocking was initiated in 1987 and has continued to increase. By the spring of 1997, the total number of fry stocked in the Connecticut Basin was nearly 8.5 million. In Massachusetts, Division of Fisheries and Wildlife personnel have stocked salmon fry from the Roger Reed State Fish Hatchery and the White River National Salmon Hatchery in the following streams in the Connecticut River Basin in Massachusetts: Mill Brook (Northfield), Fourmile Brook (Northfield), one branch and one tributary of the Manhan River, two branches and two tributaries of the Mill River, and the Sawmill River. Fifteen streams in the Deerfield River Basin, the mainstem Westfield River and twenty-two of its tributaries and the Millers River were also stocked. Since 1987, nearly 13.6 million fry have been released (Slater 2000).

In addition to releasing Atlantic salmon into the Connecticut River Basin, the Commission has worked to construct fishways at dams on the mainstem Connecticut River in Holyoke, Turners Falls, Vernon, Bellows Falls, Wilder, and on tributaries at the Leesville Dam (Salmon River), Rainbow Dam (Farmington River), and Decorative Specialties International (DSI) Dam (Westfield River). Fishways provide upstream passages for salmon returning from the ocean to spawn, as well as allow researchers areas to view, count, and collect salmon for use as broodstock. Two major utility companies that operate six mainstem hydroelectric facilities have signed agreements with the Commission. The agreements establish timeframes for the construction of downstream passage facilities that will alleviate some of the deleterious affects of turbines to smolts (USFWS 2000).

The Massachusetts Water Watch Partnership (MassWWP) conducted a “Swimming Hole” Project in 1998 (Walk *et al.* 1998). Their project was funded in part by the Massachusetts Executive Office of Environmental Affairs as part of a Massachusetts Watershed Initiative (MWI) grant. The project scope included water sampling at popular recreational areas for fecal coliform bacteria analysis along the Massachusetts portion of the Connecticut River to evaluate potential health risks. Unfortunately, this dataset does not meet minimum acceptability criteria required by EPA and MA DEP for use in reporting 305(b) assessments.

The Smith College Environmental Science Program initiated an interdisciplinary pilot study of the Mill River-Hatfield sub-watershed system through funding from the Sylvio O. Conte National Fish and Wildlife Refuge and the Clark Science Center Summer Student Research Program in the summer of 1997 (Clark Science Center 2000). The study included an analysis of hydrology and water chemistry, a biotoxicological evaluation of in-stream fauna, a population and genetic variation survey of *Alasmidonta* host fish species, a mussel population and reproduction study (since 1998), a vegetation and riparian corridor survey, and a land use analysis. The Mill River-Hatfield is also represented by an active watershed group.

The Connecticut River Watershed has many facilities, which discharge to the mainstem of the river and to several of its tributaries. The following types of NPDES discharges occur in the watershed (Hogan 2000):

- *Municipal wastewater treatment plants (WWTPs):* these facilities treat wastewater from domestic and industrial sources within the WWTP service area. They range in size from the Springfield Regional Facility with a treatment capacity of 50 MGD to the Town of Northfield WPCF which has a capacity of 0.2 MGD and treats only municipal, sanitary wastewater
- *Power Plants*: there are several power generation facilities within the watershed; they are of two types: hydro-power and oil/coal burning; water diversion and release is the main component related to the former and effluent temperature loading is most critical from the latter
- *Industrial WWTPs and non-process discharges*: the majority of industrial process wastewaters are treated at the municipal WWTP under conditions of their industrial pre-treatment program which is controlled by the municipality and is a condition of the municipal WWTP NPDES permit; the significant industrial WWTPs are listed in Appendix C, Table C1; there are several industries which have permits for the discharge of non-contact cooling water and storm water; these discharges are authorized and controlled under general permits issued to the facilities by USEPA; the associated impacts from these facilities are minimum and do not get significant environmental review from MA DEP
- *Aquaculture and Fish Hatcheries*: there are several aquaculture and fish hatchery facilities in the Connecticut River Basin. These operations raise tilapia, salmon and trout. The wastes from these facilities, particularly those to smaller tributary streams can be significant unless there is proper operation of the hatchery and a minimal discharge of waste and food. Water pollution control is best managed by implementation of BMPs (e.g., operational procedures used by the facility to enhance control of solids collection, preventative maintenance program for cleaning equipment, precautions that will be taken to prevent non-indigenous organisms from becoming established in the local surface waters, etc.).
- *Combined Sewer Overflows* (Brander 2000): The three major CSO permittees, the Cities of Springfield, Chicopee, and Holyoke, are now in the process of CSO facilities planning. Springfield and Holyoke have submitted Draft Facilities Plan/EIR documents. Chicopee is still in the process of doing the work to support their DFP/EIR. There are outstanding technical and affordability issues with all three of the CSO communities. These issues shall be resolved through further planning work, through the MEPA process, and further regulatory meetings/negotiations.

  The final facility plans, which are now expected to be filed in late 2001 or early 2002, have been delayed to allow the communities to collaborate on a receiving water quality modeling project. The receiving water model, which was developed for the Springfield plan, is being expanded to include the regional area from the Holyoke CSOs (upstream of the Holyoke Dam) south to the CT line. The modeling project, which includes some dry and wet weather instream sampling, CSO sampling, and stormdrain sampling, will allow for an improved understanding of the collective impacts of regional CSO abatement strategies.

  In the CSO impact area, the Connecticut River is Class B. A CSO-impacted segment can only be reclassified to B (CSO) or B (partial) or C if the findings of the facility planning efforts identify levels of CSO control reflective of those classifications to be the highest feasible level of control. The final facilities plan also needs to support a Use Attainability Analysis in this regard as well (Brander 2000).

There are three major hydropower projects on the Connecticut River which operate under permits issued by the Federal Energy Regulatory Commission (FERC). The licenses for these facilities were initially issued in the period 1950-1960 and are valid for 30-50 years. The licenses are currently undergoing reissuance and will be conditioned to significantly reduce environmental impacts (e.g., hydromodification, erosion, etc.).

Four of the 14 municipal wastewater treatment plants in the Connecticut River Basin submit quarterly toxicity testing reports to EPA and MA DEP as required by their NPDES permits. Data from these toxicity reports are maintained by DWM in a database entitled “Toxicity Testing Data - TOXTD”. Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and

the whole effluent toxicity test results. These data were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Connecticut River Basin. These include:

- Holyoke Water Pollution Control Facility (WPCF) (MA0101630)
- Chicopee Water Pollution Control District (WPCD) (MA0101508)
- Springfield Regional Wastewater Treatment Plant (WWTP) (MA0101613)
- Belchertown WWTP (MA0102148)

The ten smaller municipal wastewater treatment plants in the Connecticut River Basin submit semi-annual toxicity testing reports to EPA and MA DEP. These include:

- Northfield WPCF (MA0100200)
- Montague WPCF (MA0100137)
- South Deerfield WWTP (MA0101648)
- Sunderland Waste Water Treatment Facility (WWTF) (MA0101079)
- Amherst WWTP (MA0100218)
- Hatfield WWTF (MA0101290)
- Northampton Publicly Owned Treatment Works (POTW) (MA0101818)
- Hadley WWTP (MA0100099)
- Easthampton WWTP (MA0101478)
- South Hadley WWTP (MA0100455)

Three industrial NPDES discharges also conduct toxicity testing of their effluents. These include:

- Esleek Paper Company (MA0005011)
- Northfield Mt. Hermon (MA0032573)
- University of Massachusetts Coal Storage & Handling facility (MA0032689)

The following minor NPDES facilities are also listed as discharging in the Connecticut River Basin (McCollum 2000, MA DEP 2000c and 2000d). Some discharge into rivers not assessed in this report. These facilities include:

- MA0001503 JPS Elastomerics Corp. in Easthampton (Wilton Brook)
- MA0003735 Rexham Graphics, Inc., South Hadley (Buttery Brook)
- MA0034584 Auth Fuels, Inc., East Longmeadow (Pecousic Brook)
- MA0031313 Redwing Meadow Farm Fish Hatchery, Sunderland (unnamed tributary to Mill River)
- MA0026034 Hillside Nursing Home, South Deerfield (tributary to Connecticut River)
- MA0103195 Hendricks St. Wellfield, Easthampton (Broad Brook)

Registration and permit files (both public water suppliers and other industrial users) were reviewed to determine where stream segments might be affected by water withdrawal activities (LeVangie 2000, MA DEP 2000d, and McCollum 2000). The information is summarized in the segments where the withdrawals occur.

OBJECTIVES

This report summarizes information generated in the Connecticut River Basin through *Year 1* (information gathering in 1997) and *Year 2* (environmental monitoring in 1998) activities established in the "Five-year Cycle" of the Watershed Initiative. Data collected by DWM in 1998 was limited to synoptic lake surveys. Together with other sources of information (identified in each segment assessment), the status of water quality conditions of lakes and rivers in the Connecticut River Basin was assessed in accordance with EPA's and MA DEP's use assessment methods. Not all waters in the Connecticut River Basin are included in the MA DEP/EPA Water Body System (WBS) database or this report.

The objectives of this water quality assessment report are to:

1. Evaluate whether or not rivers and lakes in the Connecticut River Basin, defined as segments in the WBS database, currently support their designated uses (i.e., meet water quality standards),
2. identify water withdrawals and/or major point (wastewater discharges) and nonpoint (land-use practices, stormwater discharges, etc.) sources of pollution that may impair water quality conditions,
3. identify the presence or absence of any non-native macrophytes in lakes,
4. identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality, and
6. provide information to the Connecticut River Watershed Team for use in its annual and 5-year watershed action plan.

REPORT FORMAT

The rivers assessed in the Connecticut River Basin are presented in the *Connecticut River Basin – River Segment Assessments section* of this report. The rivers segments are ordered according to the Massachusetts Stream Classification Program (Halliwell *et al*. 1982) hierarchy, hydrologically (from most upstream to downstream). Summaries for tributary streams follow the segment into which they discharge. Each stream segment summary is formatted as follows:

Segment identification

Name, water body identification number (WBID), location, length/size, classification.

Sources of information: coding system (waterbody identification number e.g., MA34-01) used by DEP to reference the stream segment in databases such as 305(b) and 303(d), the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

Segment description

Major land-use estimates (the top three uses for the subwatershed) and other descriptive information.

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1985 and 1990-1992 (EOEA 1999a), WERO descriptive information (McCollum 2000).

Segment locator map

Subbasin map, major river location, segment origin and termination points, and segment drainage area (gray shaded).

Sources of information: MassGIS (EOEA 1999b) data layers (stream/lake segments, and quadrangle maps).

Water withdrawals and wastewater discharge permit information

Water withdrawal, NPDES wastewater discharge, and hazardous waste site summaries.

Sources of information: WMA Database Printout (LeVangie 2000); open permit files located in Worcester and Springfield DEP Offices (MA DEP 2000c and d and McCollum 2000).

Use assessment

Aquatic Life, Fish Consumption, Drinking Water (where applicable), Primary Contact, Secondary Contact, and Aesthetics.

Sources of information include: synoptic lake survey data (MA DEP 1998) data and from the DEP DWM Toxicity Testing Database "TOXTD", the MA DPH Freshwater Fish Consumption Advisory List (MA DPH 1999) was used to determine the Fish Consumption Use. Where other sources of information were used to assess designated uses, citations are included.

Summary

Use summary table (uses, status, causes and sources of impairment).

Recommendations

Additional monitoring and implementation needs.

The assessment of lakes in the Connecticut River Basin is provided in the *Connecticut River Basin – Lakes* section of this report.

CONNECTICUT RIVER BASIN – RIVER SEGMENT ASSESSMENTS (Figure 5)

Connecticut River (Segment MA34-01) 23
Connecticut River (Segment MA34-02) 28
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Temple Brook (Segment MA34-08) 93
Scantic River (Segment MA34-30) 94
Raspberry Brook (Segment MA34-22) 96

Out of an estimated total of 538 river miles in the Connecticut River Basin, approximately 44% are encompassed by the river segments included in this report.

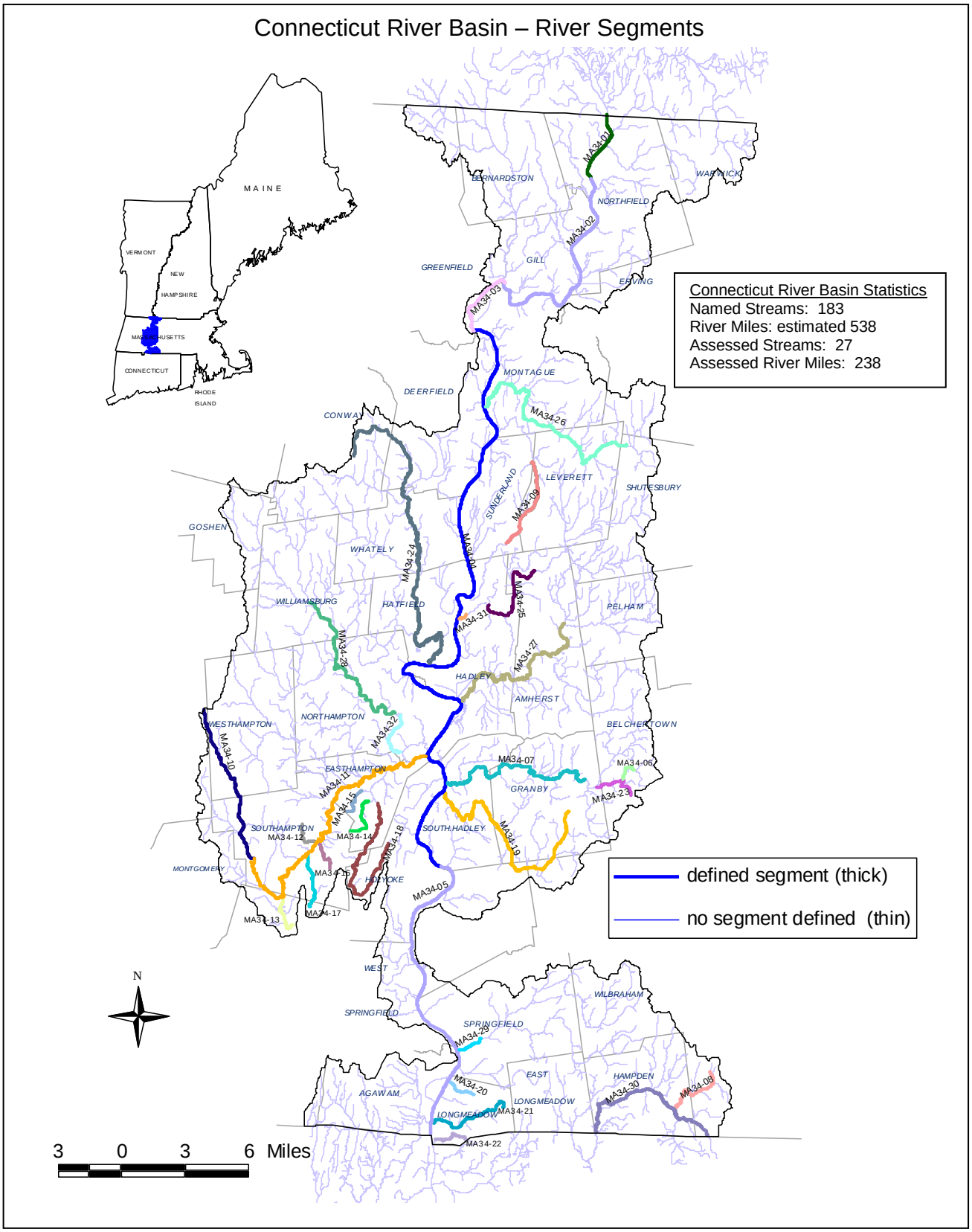


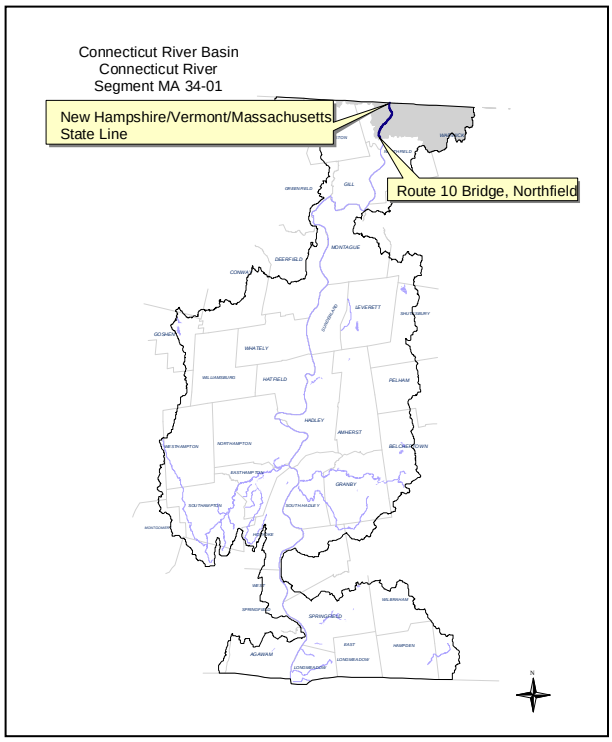
Figure 5. River Segment Locations in the Connecticut River Basin

CONNECTICUT RIVER (SEGMENT MA34-01)

Location: New Hampshire/Vermont/Massachusetts state line to Route 10 bridge, Northfield.
Segment Length: 3.5 miles.
Classification: Class B, Warm Water Fishery.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	79%
Agriculture	9%
Residential	5%



The Connecticut River from Vernon, Vermont to Turners Falls, Massachusetts, is commonly known as the Turner Falls Power Pool. This segment (MA34-01) is entirely contained within the 22 mile Turners Falls Power Pool. Three hydroelectric generating facilities directly impact the day to day hydrodynamics of the Turners Falls Power Pool: Vernon, VT, Turners Falls, and Northfield Mountain. The joint operation of the Turners Falls and the Northfield projects has significantly changed the daily regime of the river in this pool, resulting in larger and quicker pool fluctuations (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

The 1979 "Report on Connecticut River Streambank Erosion Study" Report by the Army Corps of Engineers (ACOE) attempted to identify the causes of erosion and rate the importance of each. In addition to natural causes such as shear stress and stage variation, the report identified pool fluctuations and boat waves as contributing erosional factors. Pool fluctuations were named as causing an increase in bank instability on the order of 18% of the shear stress exerted in the bank merely by flowing water. The report also identifies the difference in the nature of the erosion caused by wave action, which only works at the level of the water; and the various shear stress forces that work on the full height of the submerged bank, where the maximum shear stress is exerted on the bank below water at about 2/3 of the water's depth (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

In July of 1991, the ACOE completed a follow-up report on the erosion in the Turners Falls Pool, "General Investigation Study, Connecticut River Streambank Erosion: Connecticut River, Turners Falls Dam to State Line, MA." This study concluded that the riverbank erosion had increased almost threefold since 1979, with approximately one-third of the shoreline undergoing active erosion (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID #	WMA Permit #	WMA Registration #	Authorized Average Withdrawal	1998 Average Withdrawal
East Northfield Water Company	1217001-01S	9P2-1-06-217.02		0.14 MGD	0.089 MGD
Northfield Water District	1217000-01G				0.069 MGD
Linden Hill School	1217006-01G 1217006-02G			No safe yield	0.0017 MGD
Total withdrawal				*0.14 MGD*	*0.1597 MGD*

NPDES WASTEWATER DISCHARGE SUMMARY:

MA0100200 – Northfield WPCF (an extended aeration plant) is authorized to discharge 0.275 MGD to this segment of the Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity

are $LC_{50} \geq 50\%$ effluent. The facility's average daily flow for 1999 was 0.138 MGD. The facility has complied with its permit limits for the last three years (McCollum 2000). Effluent ammonia concentrations ranged between < 0.10 mg/L and 9.34 mg/L, and TRC measurements ranged between < 0.01 mg/L and 0.45 mg/L. The current NPDES permit expires at midnight on 29 September 2000.

USE ASSESSMENT

AQUATIC LIFE

Biology

Habitat/Flow

Three hydroelectric generating facilities directly impact the day to day hydrodynamics of the Turners Falls Power Pool: Vernon, VT, Turners Falls, and Northfield Mountain. The Connecticut River Water Quality Assessment Report prepared for the New Hampshire Connecticut River Valley Resource Commission and the Vermont Connecticut River Watershed Advisory Commission identified organic enrichment, sedimentation, turbidity, and flow alteration as probable causes of impairment (partial support) in their most downstream segment of the Connecticut River (NH DES and VT DEC 1994).

In the Turners Falls Pool section of the Connecticut, the banks of the river, which are often twenty or more feet above the water level, are characterized by slumping and mass wasting of huge sections of bank, with trees and other riparian vegetation frequently falling and sliding into the water (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999). Evidence of extreme erosion prompted a Connecticut River Watershed Restoration 319 Project that was conducted between 1996 and 1998. As part of this project conducted by the Franklin Regional Council of Governments and the CRSEC, two sites in this segment of the Connecticut River were selected for streambank restoration via design and installation of bioengineered bank stabilization (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

- The Wickey Site was located on the western side of the river. Banks were high and steeply eroded as a result of mass wasting-type erosion, with bare slopes and no trees remaining on the top of the bank. Construction at the Wickey Site (330 feet in length) was conducted in the fall/winter of 1996, and planting was conducted between fall of 1996 and spring of 1997.
- The Crooker site was located on the west bank of the river just upstream of the Route 10 bridge. Banks at the site were steep and extremely eroded. A total of 760 feet of bank was constructed in the summer of 1997, and planted between the fall of 1997 and the fall of 1998.

Toxicity

Ambient

Northfield WPCF collects Connecticut River water (from the boat ramp north of Schell Bridge in Northfield) for use as dilution water in their whole effluent toxicity tests. Between May 1996 and May 1999, survival of *Ceriodaphnia dubia* and *Pimephales promelas* exposed (48-hour) to the river water was not less than 75%.

Effluent

Northfield WPCF also conducted six effluent toxicity tests on *C. dubia* and *P. promelas* between May 1996 and May 1999 and two additional tests using *C. dubia* in May 1998 and August 1999. The LC_{50}'s were all $\geq$ 100% effluent.

Chemistry - water

pH

Measurements of pH in the Connecticut River (from the boat ramp north of Schell Bridge in Northfield) reported in Northfield WPCF toxicity testing reports ranged between 6.9 SU and 7.6 SU.

Suspended Solids

Measurements of SS in the Connecticut River (from the boat ramp north of Schell Bridge in Northfield) reported in Northfield WPCF toxicity testing reports ranged between <10 mg/L and 16 mg/L.

Ammonia-Nitrogen

Dilution water measurements of ammonia (as N) in the Connecticut River (from the boat ramp north of Schell Bridge in Northfield) reported in the Northfield WPCF toxicity testing reports ranged between <0.05 mg/L and 0.40 mg/L.

Total Residual Chlorine

TRC was not detected in the Connecticut River (from the boat ramp north of Schell Bridge in Northfield) as reported in the Northfield WPCF toxicity testing reports.

Hardness

Measurements of hardness in the Connecticut River (from the boat ramp north of Schell Bridge in Northfield) reported in Northfield WPCF toxicity testing reports ranged between 26 mg/L and 44 mg/L.

Chemistry - tissue

Results of the USGS NAWQA study documented elevated levels of total PCB in fish at four sampling stations along the mainstem Connecticut River which exceeded the NAS/NAE guidelines for the protection of fish-eating wildlife (Coles 1998). While this dataset however is limited to only one sample per station, the presence of PCB in fish throughout the entire mainstem Connecticut River (in MA), places the *Aquatic Life Use* on "Alert Status".

This segment of the Connecticut River is assessed as partially supporting the *Aquatic Life Use* based on flow and habitat alteration. PCB contamination has also been identified as an issue of concern ("Alert Status") for this use.

FISH CONSUMPTION

MA DPH issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow), recommending that children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB (MA DPH 1999).

Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. Fish sampling for this project was initiated in 2000. This project is being managed by NEIWPCC and US EPA NERL. A summary of this project and its study objectives are presented in Appendix B.

Because of the MA DPH fish consumption advisory, the entire 3.5 miles of this segment do not support the *Fish Consumption Use*.

Connecticut River (Segment MA34-01) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life*		PARTIAL SUPPORT	Flow alteration, habitat alteration	Hydromodification, habitat modification
Fish Consumption		NON SUPPORT	PCB contamination	Unknown
Primary Contact		NOT ASSESSED		
Secondary Contact		NOT ASSESSED		
Aesthetics		NOT ASSESSED		

**** "Alert Status"*** issues identified – details in Chemistry-tissue

RECOMMENDATIONS CONNECTICUT RIVER (SEGMENT MA34-01)

- Historically, elevated fecal coliform bacteria levels were documented in this segment of the Connecticut River. Monitoring of fecal coliform bacteria should be conducted under both wet and dry sampling conditions to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

- Review the results of the *Fish Tissue Testing in the Connecticut River* study developed by the Connecticut River Forum in 1999.

- Evaluate the effectiveness of streambank stabilization projects (for both immediate and long-term effects) along this segment of the Connecticut River.

- Specific recommendations from the 1994 Connecticut River Water Quality Assessment Report applicable to this segment of the Connecticut River include the following (NH DES and VT DEC 1994):
  - The effects of dams on water quality and aquatic life in the Connecticut River and its tributaries should be comprehensively reviewed by state and federal resource agencies to balance the hydropower generation use with water quality uses and values.
  - River and streambank erosion is a major problem for the Connecticut River, its tributaries, and adjacent landowners; habitat assessment to evaluate river siltation and embeddedness should be included in the erosion surveys. Further research on erosion causes and remediation options should be conducted. Implementation of river and streambank stabilization projects should continue to be a high priority for funding (native vegetation should be utilized to the greatest extent possible). Maintenance of vegetated riparian buffers is recommended and should be a part of any river and streambank restoration project.
  - Within the limits of available funding, state agencies and volunteer monitors should expand their water quality assessment techniques to include a mix of physical habitat surveys and chemical, bacteriological, and biological sampling to better assess the overall health of the surface waters in the Connecticut River Watershed. Additional site-specific assessment of the impact of dams on water quality is needed. Macroinvertebrate and fish sampling studies bracketing sources suspected of pollution is needed.

Point source

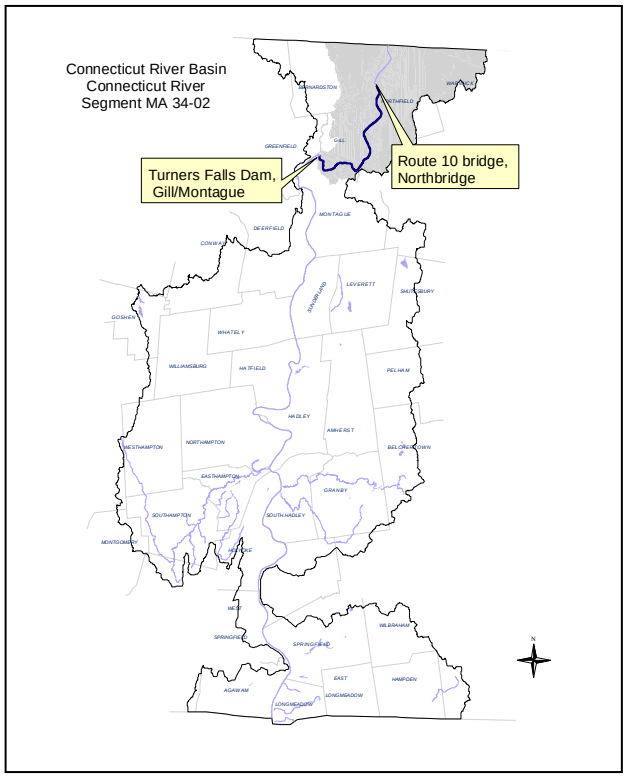
- Reissue Northfield WPCF NPDES permit (MA0100200) which expires at midnight on 29 September 2000. Evaluate the need to address far field nutrient loading from this facility to Long Island Sound. Evaluate the need to obtain a Phase 2 storm water permit.

- Operations of the FERC Licensees (Project #2485 Northfield Mountain Power Station, Project # 1889 Turners Falls Station (Connecticut River) and Project # 2622 Turners Falls (Connecticut Canal) and

the Vernon, VT Station) should be reexamined to develop a plan minimize streamflow fluctuations which are known to contribute to streambank erosion in the Turners Falls Power Pool. Site specific studies should be required of the licensees at both the impoundments and downstream of the dams. State agencies should evaluate site specific chemistry data within impoundments to document dissolved oxygen and the extent of algal problems. New Hampshire, Vermont [and Massachusetts] should coordinate their respective 401 certificate review with the goal of consistent conditions and monitoring requirements (NH DES and VT DEC 1994).

CONNECTICUT RIVER (SEGMENT MA34-02)

Location: Route 10 bridge, Northfield to Turners Falls Dam, Gill/Montague.
Segment Length: 10.9 miles.
Classification: Class B, Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	72%
Agriculture	12%
Residential	5%

This segment of the Connecticut River (MA34-02) is entirely contained within the 22 mile Turners Falls Power Pool. One of the three hydroelectric generating facilities that directly impacts the day to day hydrodynamics of the Turners Falls Power Pool is located within this segment, Northfield Mountain Pumped Storage Project. The joint operation of the Turners Falls and the Northfield projects has significantly changed the daily regime of the river in this pool, resulting in larger and quicker pool fluctuations than would naturally occur (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

The Northfield Mountain Pumped Storage Project located about five miles upstream of the Turners Falls dam, consists of an upper reservoir and an underground pumping and generating plant which uses reversible pump turbine units. The Project also relies on the Turners Falls Pool to serve as a lower reservoir. During periods of low electrical demand, the Northfield Mountain Pumped Storage Facility pumps water from the lower reservoir to the upper reservoir using the pump turbine generators. The water is then released during periods of high electrical demand, again through the pump turbine generators. In this way, the project is able to generate a maximum of 1080 megawatts of electricity. The increase in dam height over time, from 163.9 feet in 1867 to 185.5 feet in 1970 (21.6 feet in 103 years), has significantly altered the hydrodynamics of the reach. The joint operation of the Turners Falls and the Northfield projects has also significantly changed the daily regime of the river in the Turners Falls Pool, resulting in larger and quicker pool fluctuations. Typically, pool fluctuations may average as much as 3.5 feet per day, and much higher fluctuations (9-10.5 feet) may occur over the weekly cycle (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

[NOTE : Rare Species Habitat - The main stem of the Connecticut River here has been identified as Estimated Habitat for Rare Wildlife, including Bass Swamp, Millers Brook tributaries in the vicinity of Pratt Hollow and the Gulf Road, and the area around Sawyers Ponds (McCollum 2000). Fisheries – Mill Brook and Fourmile Brook, both tributaries to this segment of the Connecticut River, are stocked with salmon fry by the Massachusetts Division of Fisheries and Wildlife as part of the ongoing Atlantic Salmon Restoration Program (McCollum 2000).]

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Average Withdrawal	1999 Average Withdrawal
Reach 02A Route 10 Bridge in Northfield downstream to confluence with Millers River.					
French King Motor Inn	1091009-01G				NM/NE*
Northfield Mt. Station and Visitors Center	1217003-01G 1217003-02G				0.0005 MGD 0.0023 MGD
Riverview Picnic Area	1217005-01G				0.0003 MGD
Lane Construction		9P-1-06-217.01		Below threshold Withdrawn	
Reach 02B Confluence with Millers River downstream to Turners Falls Dam in Montague.					
Purple Meadow Campground, Bernardston	1029001-01G				0.0005 MGD
Northfield Mount Herman School, Gill	1106002-01G				0.0700 MGD
Gill Elementary School, Gill	1106004-01G				0.0005 MGD
Pioneer Valley Regional High School, Northfield	1029001-01G				Not metered
Barton's Cove Campground	1106006-01G				0.0003 MGD
Alan's Bar B Que	1106007-01G				NM/NE
AquaFutures AquaPartners		9P-1-06-192.02		0.41 MGD	0.251 MGD
Total Withdrawal				*0.41 MGD*	*0.3254 MGD*

* NM/NE Not Metered/No Estimate

NPDES WASTEWATER DISCHARGE SUMMARY:

Reach 02A Route 10 Bridge in Northfield downstream to confluence with Millers River.

MA0032573- Northfield Mt. Hermon School WWTP is authorized to discharge 0.45 MGD to this segment of the Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity are $LC_{50} \geq$ 50% effluent. The facility's average daily flow for 1999 was 0.102 MGD. The facility consists of three aerated lagoons with an overall detention time of 30 days, followed by a clariflocculator. While the school has some inflow and infiltration problems, due to the detention time of the lagoons the facility has consistently met its permit limits for the last three years (McCollum 2000). Effluent measurements of TRC ranged between 0.02 mg/L and 0.45 mg/L, and ammonia (as N) concentrations ranged between 0.76 mg/L and 8.25 mg/L. The current NPDES permit expires at midnight on 29 September 2000.

MA0035530 – Western Massachusetts Electric Company, Northfield Mountain Station (owned by Northeast Utilities Service Company) is a hydroelectric station producing electricity (Appendix C, Table C2). Their 2000 permit application indicates two outfalls 002 (tailrace) and 003 surface discharge swale which both discharge to the Connecticut River. Their application states 44.2 million gallons per year (MGY) annual water consumption with the following effluent characteristics: 66 MG average monthly and 2.2 MGD maximum daily, 4-13 ºC average monthly and 13 ºC maximum daily and pH limits are 6.8-7.4 SU average monthly and 7.4 SU average monthly. The facility also has a FERC permit (see below).

Reach 02B Confluence with Millers River downstream to Turners Falls Dam in Montague.

MA0110264 – Fins Technology WWTP (permit transfer 15 December 1999, formerly AquaFuture, Inc. or Aqua Partners Technologies, LLC) (Appendix C, Table C3). This facility is located just upstream from the dam and on the south side of the river in Montague along River Rd. The permit expires at midnight on 21October 2000. The facility's average daily flow for 1999 was 0.149 MGD with a permit limit of 0.5 MGD. The facility raises striped bass. The treatment facility consists of two primary settling tanks, two submerged biofilters and a drum filter. Solids are stored in a fish manure tank. The supernatant from the tank discharges to the Town of Montague's sewer system. The facility has complied with its permit limits for the last three years (McCollum 2000).

FEDERAL ENERGY REGULATORY COMMISSION (FERC):

Project Name	Owner	Project #	Issue Date	Expiration Date	River	Kilowatts
Northfield Mountain Power Station	Western MA Electric Co.	2485	14 May 1968	30 April 2018	Connecticut River	1,000,000

USE ASSESSMENT

AQUATIC LIFE

Biology

Habitat/Flow

Three hydroelectric generating facilities directly impact the day to day hydrodynamics of the Turners Falls Power Pool: Vernon, VT, Turners Falls, and Northfield Mountain. The Connecticut River Water Quality Assessment Report prepared for the New Hampshire Connecticut River Valley Resource Commission and the Vermont Connecticut River Watershed Advisory Commission identified organic enrichment, sedimentation, turbidity, and flow alteration as probable causes of impairment (partial support) in their most downstream segment of the Connecticut River (NH DES and VT DEC 1994).

The banks of the Connecticut River in the Turners Falls Pool section are often twenty or more feet above the water level, and are characterized by slumping and mass wasting of huge sections of streambank. Trees and other riparian vegetation frequently fall and slide into the water (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999). Evidence of extreme erosion prompted a Connecticut River Watershed Restoration 319 Project that was conducted between 1996 and 1998. As part of this project conducted by the Franklin Regional Council of Governments and the CRSEC, one site in this segment of the Connecticut River was selected for streambank restoration via design and installation of bio-engineered bank stabilization (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999).

- Streambank at the Shearer Site were steeply eroded with high bare slopes. Construction at the Shearer Site (1160 feet in length) began in early November and continued through Christmas 1996. Planting was conducted in the winter of 1996 and repairs were made in the spring of 1997.

Toxicity

Ambient

Northfield Mt. Hermon School WWTP collects Connecticut River water (south of Bailey Brook in Gill) for use as dilution water in their whole effluent toxicity tests. Between May 1996 and May 2000, survival of *C. dubia* exposed (48-hour) to the river water was not less than 95%.

Effluent

Northfield Mt. Hermon School WWTP also conducted eight effluent toxicity tests on *C. dubia* between May 1996 and May 2000. The LC_{50}'s were all $\geq$ 100% effluent.

Chemistry - water

pH

Measurements of pH in the Connecticut River (south of Bailey Brook in Gill) reported in the Northfield Mt. Hermon School toxicity testing reports ranged between 6.9 SU and 7.4 SU.

Suspended Solids

Except for one data point (53 mg/L), measurements of suspended solids in the Connecticut River (south of Bailey Brook in Gill) reported in the Northfield Mt. Hermon School toxicity testing reports were all less than 6 mg/L.

Ammonia-Nitrogen

Measurements of ammonia (as N) in the Connecticut River (south of Bailey Brook in Gill) reported in the Northfield Mt. Hermon School toxicity testing reports ranged between <0.05 mg/L and 0.34 mg/L.

Total Residual Chlorine

Measurements of TRC in the Connecticut River (south of Bailey Brook in Gill) reported in the Northfield Mt. Hermon School toxicity testing reports were between < 0.02 mg/L and 0.05 mg/L.

Hardness

Measurements of hardness in the Connecticut River (south of Bailey Brook in Gill) reported in the Northfield Mt. Hermon School toxicity testing reports ranged between 26 and 52 mg/L.

Chemistry - tissue

Results of the USGS NAWQA study documented elevated levels of total PCB in whole fish collected at four sampling stations along the mainstem Connecticut River which exceeded the NAS/NAE guidelines for the protection of fish-eating wildlife (Coles 1998). While this dataset however is limited to only one sample per station, the presence of PCB in fish throughout the entire mainstem Connecticut River (in MA), places the *Aquatic Life Use* on "Alert Status".

This segment of the Connecticut River is assessed as partially supporting the *Aquatic Life Use* based on flow and habitat alteration. PCB contamination has also been identified as an issue of concern ("Alert Status") for this use.

FISH CONSUMPTION

MA DPH issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow), recommending that children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB (MA DPH 1999).

Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. Fish sampling for this project was initiated in 2000. This project is being managed by NEIWPCC and US EPA NERL. A summary of this project and its study objectives are presented in Appendix B.

Because of the MA DPH fish consumption advisory, the entire 10.9 miles of this segment do not support the *Fish Consumption Use*.

Connecticut River (Segment MA34-02) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life*		PARTIAL SUPPORT	Flow alteration, habitat alteration	Hydromodification, habitat modification
Fish Consumption		NON SUPPORT	PCB contamination	Unknown
Primary Contact		NOT ASSESSED		
Secondary Contact		NOT ASSESSED		
Aesthetics		NOT ASSESSED		

**** "Alert Status"*** issues identified – details in Chemistry-tissue

RECOMMENDATIONS CONNECTICUT RIVER (SEGMENT MA34-02)

- Historically, elevated fecal coliform bacteria levels were documented in this segment of the Connecticut River. Monitoring of fecal coliform bacteria should be conducted under both wet and dry sampling conditions to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

- Review the results of the *Fish Tissue Testing in the Connecticut River* study developed by the Connecticut River Forum in 1999.

- Investigate the amount of natural erosion compared to erosion associated with anthropogenic sources (hydropower, recreation, agriculture, etc.).

- Evaluate the effectiveness of streambank stabilization projects (for both immediate and long-term effects) along this segment of the Connecticut River.

- Specific recommendations from the 1994 Connecticut River Water Quality Assessment Report applicable to this segment of the Connecticut River include the following (NH DES and VT DEC 1994):
  - The effects of dams on water quality and aquatic life in the Connecticut River and its tributaries should be comprehensively reviewed by state and federal resource agencies to balance the hydropower generation use with water quality uses and values.
  - River and streambank erosion is a major problem for the Connecticut River, its tributaries, and adjacent landowners; habitat assessment to evaluate river siltation and embeddedness should be included in the erosion surveys. Further research on erosion causes and remediation options should be conducted. Implementation of river and streambank stabilization projects should continue to be a high priority for funding (native vegetation should be utilized to the greatest extent possible). Maintenance of vegetated riparian buffers is recommended and should be a part of any river and streambank restoration project.
  - Within the limits of available funding, state agencies and volunteer monitors should expand their water quality assessment techniques to include a mix of physical habitat surveys and chemical, bacteriological, and biological sampling to better assess the overall health of the surface waters in the Connecticut River Watershed. Additional site-specific assessment of the impact of dams on water quality is needed. Macroinvertebrate and fish sampling studies bracketing sources suspected of pollution is needed.

<u>Point source</u>

- MA0032573- Northfield Mt. Hermon School WWTP permit expires at midnight on 29 September 2000. Reissue the permit and determine the need for this facility to develop a long-term sludge disposal plan.

- MA0110264 – Fins Technology WWTP (formerly AquaFuture, Inc. or Aqua Partners Technologies, LLC) permit expires at midnight on 21October 2000. Reissue permit.

- MA0035530 – Western Massachusetts Electric Company, Northfield Mountain Station (owned by Northeast Utilities Service Company) is a hydroelectric station producing electricity. A non-consumptive use determination was issued by MA DEP on 14 March 2000 for their facilities at Cabot Station, Turners Falls #1 and Northfield Mountain Project stations. However, if their NPDES application was correct (44.2 MGY annual water consumption) they may actually be subject to WMA regulations (36.5 MG over a calendar year exceeds the WMA permit threshold) (LeVangie 2000). Confirm the permit application volumes and proceed with permitting actions (WMA, NPDES) as necessary.

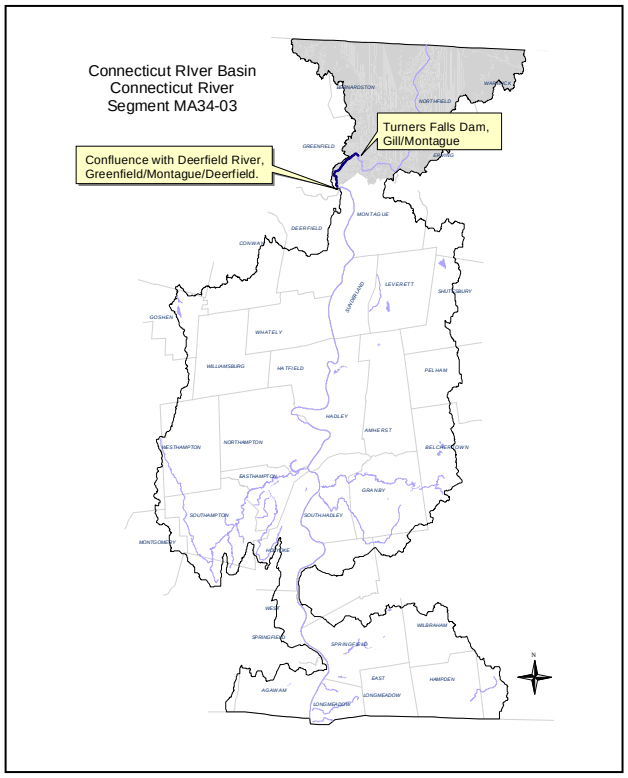
  [Note: The Water Management Act regulations (310 CMR 36:38) specifically define non-consumptive use as "any use of water which results in its being discharged back into the same water source at or near the withdrawal point in substantially unimpaired quality and quantity." Historically hydropower has been treated as a non-consumptive use. Those making such a withdrawal "must demonstrate to the satisfaction of the Department, that the volume of the water meets the definition of non-consumptive use in these regulations, and that no other existing registered or permitted withdrawers are substantially affected."]

- Operations of the FERC Licensees (Project #2485 Northfield Mountain Power Station, Project # 1889 Turners Falls Station (Connecticut River) and Project # 2622 Turners Falls (Connecticut Canal) and the Vernon, VT Station) should be reexamined (permit expires in 2018) to develop a plan minimize streamflow fluctuations which are known to contribute to streambank erosion in the Turners Falls

Power Pool. Site specific studies should be required of the licensees at both the impoundments and downstream of the dams. State agencies should evaluate site specific chemistry data within impoundments to document dissolved oxygen and the extent of algal problems. New Hampshire, Vermont [and Massachusetts] should coordinate their respective 401 certificate review with the goal of consistent conditions and monitoring requirements (NH DES and VT DEC 1994).

CONNECTICUT RIVER (SEGMENT MA34-03)

Location: Turners Falls Dam, Gill/Montague to confluence with Deerfield River, Greenfield/Montague/Deerfield.
Segment Length: 3.0 miles.
Classification: Class B, Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	71%
Agriculture	13%
Residential	6%

Wetland Protection Interests
This watershed segment contains the Montague Plain, an extensive sand plain area that includes Pitch Pine-Oak, Pitch Pine/Scub Oak and scrub oak shrubland and sandplain grassland vegetation communities. The Montague Plain area includes Estimated Habitats of Rare Wildlife, which are designated as Priority Habitats of Rare Species (there are a number of rare plant and animal species in this area). Montague Wildlife Management Area and one part of the Montague State Forest are located in the Montague Plain. Additional habitat types in this segment include riverbank and river island communities associated with the Connecticut River (McCollum 2000).

The Connecticut River is diverted at Turner's Falls Dam into the Northeast Utility's power canal (7000 feet long by 120 feet wide) where it is used to generate hydroelectric power. Approximately two miles of the mainstem Connecticut River are bypassed and water is returned to the Connecticut River at low flows via Cabot Station and at high flows via the Montague Dam and Cabot Station.

The US Fish and Wildlife Service operates Conte Lab, an anadromous fish laboratory on this segment of the Connecticut River. The Conte Anadromous Fish Lab is a world-class, fish passage and engineering research facility on 20 acres adjacent to the Connecticut River in northwestern Massachusetts. Laboratory staff conduct research on the ecological, physiological and behavioral characteristics of anadromous and migratory species. The lab plays a critical role in the evaluation, design and development of prototype fish passage facilities, particularly for migratory species that must negotiate around man-made barriers. The most frequently studied species are "anadromous" fishes who grow to maturity in salt water, but which migrate to rivers to spawn and spend a portion of their juvenile lives (USGS 2000).

[NOTE : Fisheries – Fall Brook, a tributary to this segment of the Connecticut River, is stocked with salmon fry by the Massachusetts Division of Fisheries and Wildlife as part of the ongoing Atlantic Salmon Restoration Program (Slater 2000).]

Water Withdrawal Summary:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Average Withdrawal	1999 Average Withdrawal
Esleeck Mfg. Co., Inc., 80 Canal Street, Montague			1-06-192-03	0.880 MGD	0.688 MGD
Bernardston Fire & Water District, Bernardston (Sugarhouse Well)	1029000-03G	9P1-01-06-029.1		0.170 MGD	0.205 MGD
Total withdrawals				*1.050 MGD*	*0.893 MGD*

NPDES WASTEWATER DISCHARGE SUMMARY:

MA0005011 Esleeck Manufacturing Company, Inc. (formerly Strathmore Paper Company transferred September 1995). There are two permitted discharges from Esleeck Manufacturing (outfalls 001 and 003) neither of which have a maximum flow limit.

- Outfall 001 discharges water supply filter backwash into this segment of the Connecticut River. Transfer request letter from Esleeck indicates that this discharge is no longer active.
- Outfall 003 discharges into the Power canal and consists of combined (Strathmore and Esleeck paper companies) treated process wastewater. Benthic Oxygen Demand (BOD) permit limits for outfall 003 include a monthly average mass loading of 660 pounds/day BOD and a maximum daily limit 1320 pounds/day BOD. Total Suspended Solids (TSS) monthly average limits for this outfall are 500 pounds/day and a maximum daily limit 1000 pounds per day. A brief review of 1999 DMRs show average flow of approximately 0.7 to 0.8 MGD, with average daily discharges of 380 pounds/day and 100 pounds per day of BOD and TSS, respectively (equivalent to discharge concentrations of 65 mg/L BOD and 26 mg/L TSS). A review of the DMRs indicates that the facility has complied with its permit limits in recent years (McCollum 2000). The permit limits for whole effluent toxicity are $LC_{50} \geq$ 50% effluent (Appendix C, Table C1). The facility is also required to report the results of chronic toxicity testing (monitoring only required). Effluent ammonia concentrations reported in the Esleeck Manufacturing Company toxicity reports ranged between <0.02 mg/L and 1.80 mg/L. TRC was not detected in the effluent.

MA0003964 Esleek Manufacturing Company issued in 1976 and expired in 1981. This facility is permitted to discharge non-contact cooling water, surface runoff, water wheel wastage and water wheel discharge through outfall 001 to the Connecticut River in Turner's Falls. Outfall #002 was eliminated in 1974. The permit has been administratively continued (expired permit remains in effect until a new permit is issued).

MA0035521 Cabot Station NEUSC/WME issued in 1995 and expires in September 2000. The NPDES reapplication file indicates seven (appears to be internal) outfalls (including sump for high water, groundwater drain pipes, transformer cooling pit, pit drains, floor drains, and water seal leakage at each unit) which ultimately discharge into one outfall into the Connecticut River.

FEDERAL ENERGY REGULATORY COMMISSION (FERC):

Project Name	Owner	Project #	Issue Date	Expiration Date	River	Kilowatts
Turners Falls	International Paper Company	2622	29 June 1999	28 February 2021	Connecticut Canal	937
Turners Falls	Western Massachusetts Electric Company	1889	05 May 1980	30 April 2018	Connecticut River	56,573

Western Massachusetts Electric Company's (WMECO) Turner's Falls project diverts water from the Connecticut River to generate hydroelectric power. The project is generally operated as run-of-river with negligible ponding (Monahan 2000). River water is deflected at the Gill Spillway into the Turner's Falls Dike. The Turner's Falls Station No. 1 is a base load plant and is operated at river flows between 12,000 cfs and 15,000 cfs. Water is held in a power canal that is 7000 feet long by 120 feet wide. This effectively renders about two miles of the mainstem Connecticut River into a virtually dry streambed for part of the year with most impact during the low-flow periods of the year (Hogan 2000). Water is returned to the Connecticut River at low flows via Cabot Station and at high flows via the Montague Dam and Cabot Station. The Cabot Station is operated during low flows as a peaking plant and during high flows (<12,000 cfs) it operates as a base load plant (Monahan 2000). The Federal Energy Regulatory Commission requires that a minimum flow of 1433 cfs (or a flow equal to the inflow into the reservoir) be released, although the minimum flow may be temporarily adapted during operating emergencies beyond WMECO's control or to protect fisheries resources and recreation. During fish migration season, 400 cfs is released from the dam. The flow from the dam then decreases to 125 cfs until November. From November to the fish migration season, all flow is released via the Cabot Station (Monahan 2000).

USE ASSESSMENT

AQUATIC LIFE

Biology

Habitat/Flow

The Turner's Falls project diverts water into a power canal and renders about two miles (2.3) of the main stem river into a virtually dry stream bed for part of the year with most impact during the low-flow periods of the year (Hogan 2000).

Chemistry – water

Although no instream water quality sampling was conducted in the mainstem of the Connecticut River, data for the power canal (Esleeck Manufacturing Company toxicity testing reports) are summarized below:

POWER CANAL

Toxicity

Ambient

Esleeck Manufacturing Company collects Connecticut River water (50 yards upstream from their discharge to the power canal) for use as dilution water in their whole effluent toxicity tests. Between October 1996 and April 2000, survival of test organisms exposure to the river water was not < 80% (*C. dubia* ≥80% and *P. promelas* ≥85%) during the 7-day toxicity test.

Effluent

Esleeck Manufacturing Company also conducted 15 effluent toxicity tests on *C. dubia* and *P. promelas* between October 1996 and April 2000. The LC50's ranged between 56% and >100% effluent. CNOECs ranged from 25 to 100% effluent for *C. dubia* and <6.25 to 100% effluent for *P. promelas.* The test organism, *P. promelas*, was equally or more sensitive than the *C. dubia* in all chronic tests.

Chemistry - water

pH

Measurements of pH in the Power Canal (50 yards upstream from their discharge to the power canal) reported in the Esleeck Manufacturing Company toxicity testing reports ranged between 6.5 SU and 7.6 SU (Dallaire 2000a).

Suspended Solids

Measurements of suspended solids in the Power Canal (50 yards upstream from their discharge to the power canal) reported in the Esleeck Manufacturing Company toxicity testing reports ranged between < 5.0 mg/L and 250 mg/L with 33% greater than 25 mg/L.

Ammonia-Nitrogen

Measurements of ammonia in the Power Canal (50 yards upstream from discharge on the power canal) reported in Esleeck Manufacturing Company toxicity testing reports ranged between 0.03 mg/L and 0.16 mg/L.

Total Residual Chlorine

Esleeck Manufacturing Company toxicity testing reports detected no TRC in the Power Canal.

Hardness

Measurements of hardness in the Power Canal reported in the Esleeck Manufacturing Company toxicity testing reports ranged between 4 mg/L and 56 mg/L.

Chemistry – sediment

USGS as part of their NAWQA study, analyzed sediment collected from the Connecticut River at Montague City. The concentration of total PCB was <50 PPM (Harris 1997). This sediment sample was comprised primarily of sand (88%) and silt (12%) while the total organic carbon (TOC) was 1.82%. Cadmium (0.6 PPM) was at the L-EL while chromium (90 PPM), copper (30 PPM), lead (33 PPM), nickel (34 PPM) and zinc (130 PPM) exceeded the L-EL guidelines (Persaud *et al.* 1993). Iron (4.7%) and manganese (1,600 PPM) exceeded the S-EL guidelines.

*Note: The S-EL guideline for PCB varies depending on the total organic carbon content (TOC) in the sample. Results have been summarized above using a conservative TOC estimate of 1% (where the S-EL = 5.3 PPM) and the maximum guidance allowable TOC of 10% (where the S-EL = 53 PPM).

Chemistry – tissue

At the USGS NAQWA study site on the Connecticut River at Montague City the concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) was 820 μg/kg wet weight (Coles 1998). This level of PCB exceeded (1.6 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500μg/kg wet weight for the protection of fish-eating wildlife. Neither total DDT nor total chlordane exceeded the NAS/NAE guidelines. This dataset is too limited (one sample per station) to assess the *Aquatic Life Use* as non support thereby placing it on "Alert Status".

Although Fall River discharges into this segment of the Connecticut River just below the Turner's Falls Dam, the majority of the Connecticut River is diverted through the power canal. This renders a reach of the Connecticut River into a virtually dry streambed for part of the year, and therefore the *Aquatic Life Use* is not supported for 2.3 miles. The lower 0.7 miles of this segment (downstream from the power canal) are assessed as partial support due to elevated suspended solids. PCB contamination has also been identified as an issue of concern ("Alert Status") for this use.

FISH CONSUMPTION

MA DPH issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow), recommending that "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB (MA DPH 1999).

Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. Fish sampling for this project was initiated in 2000. This project is being managed by NEIWPCC and US EPA NERL. A summary of this project and its study objectives are presented in Appendix B.

Because of the MA DPH fish consumption advisory, the entire 3.0 miles of this segment do not support the *Fish Consumption Use*.

Connecticut River (Segment MA34-03) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life*		NON SUPPORT Upper 2.3 miles PARTIAL SUPPORT Lower 0.7 miles	Flow alteration Unknown, suspended solids	Unknown, Hydromodification
Fish Consumption		NON SUPPORT	PCB contamination	Unknown
Primary Contact		NOT ASSESSED		
Secondary Contact		NOT ASSESSED		
Aesthetics		NOT ASSESSED		

**** "Alert Status"*** issues identified – details in Chemistry-tissue

RECOMMENDATIONS CONNECTICUT RIVER (SEGMENT MA34-03)

- Historically, elevated fecal coliform bacteria levels were documented in this segment of the Connecticut River. Monitoring of fecal coliform bacteria should be conducted under both wet and dry sampling conditions to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

- Review the results of the *Fish Tissue Testing in the Connecticut River* study developed by the Connecticut River Forum in 1999.

- Investigate the amount of natural erosion compared to erosion associated with anthropogenic sources (hydropower, recreation, agriculture, etc.).

- Specific recommendations from the 1994 Connecticut River Water Quality Assessment Report applicable to this segment of the Connecticut River include the following (NH DES and VT DEC 1994):
  - The effects of dams on water quality and aquatic life in the Connecticut River and its tributaries should be comprehensively reviewed by state and federal resource agencies to balance the hydropower generation use with water quality uses and values.
  - River and streambank erosion is a major problem for the Connecticut River, its tributaries, and adjacent landowners; habitat assessment to evaluate river siltation and embeddedness should be included in the erosion surveys. Further research on erosion causes and remediation options should be conducted. Implementation of river and streambank stabilization projects should continue to be a high priority for funding (native vegetation should be utilized to the greatest extent possible). Maintenance of vegetated riparian buffers is recommended and should be a part of any river and streambank restoration project.
  - Within the limits of available funding, state agencies and volunteer monitors should expand their water quality assessment techniques to include a mix of physical habitat surveys and chemical, bacteriological, and biological sampling to better assess the overall health of the surface waters in the Connecticut River Watershed. Additional site-specific assessment of the impact of dams on water quality is needed. Macroinvertebrate and fish sampling studies bracketing sources suspected of pollution is needed.

- Elevated levels of suspended solids have been measured in the Power Canal (50 yards upstream from their discharge to the power canal) reported in the Esleeck Manufacturing Company toxicity testing reports. Investigate possible sources of these conditions (e.g., erosion, runoff).

<u>Point source</u>

- The Turner's Falls project diverts water into a power canal and renders about two miles of the main stem river into a virtually dry stream bed for part of the year with most impact during the low-flow periods of the year (Hogan 2000). Maximize streamflow to this segment of the Connecticut River. Operations of the FERC Licensees (Project # 1889 Turners Falls Station (Connecticut River) and Project # 2622 Turners Falls, Connecticut Canal) should be reexamined to develop a plan to maintain adequate flow in the by-pass reach of the Connecticut River for the protection of aquatic life.

- Evaluate stormwater controls/ needs along the power canal.

- The NPDES permit MA0035521 for NEUSC/WME's Cabot Station in Montague that expired in September 2000 should be reissued with appropriate limits and monitoring requirements.

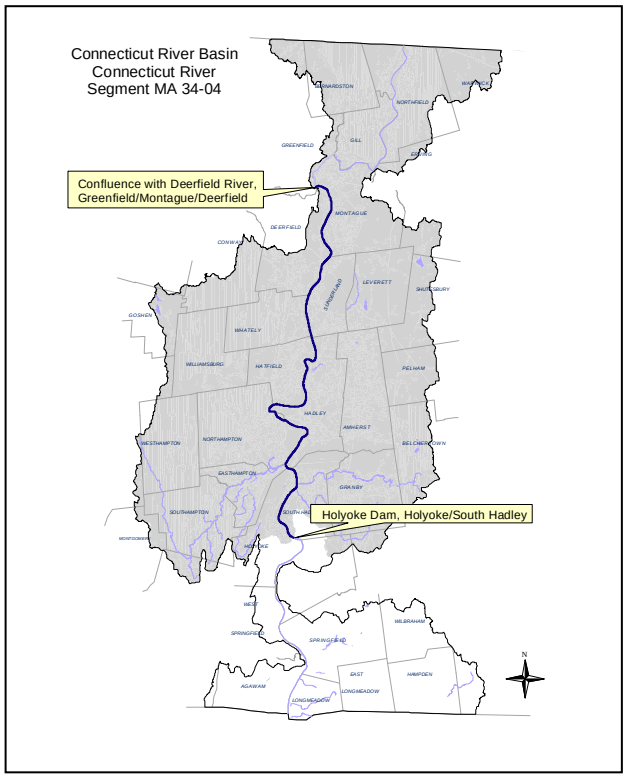
- Investigate the possibility of non-permitted CSO discharges into this segment of the Connecticut River in the village of Turners Falls (town of Montague). [Note: The 1983 sewer separation design for the Montague WPCF included a regulator structure (near 7th Street) expected to discharge approximately four times per year.] The current status of this structure needs to be determined (e.g., clogged). Remediate problem if necessary.

- Esleeck Manufacturing Company, Inc. (MA0005011) (formerly Strathmore Paper Company). Reduce toxicity testing requirements to one organism, *P. promelas* as it is has been consistently more sensitive. Confirm whether or not Outfall #001 is still active and reissue the permit.

- Esleeck Manufacturing Company, Inc. (MA0003964) permit should be reissued.

CONNECTICUT RIVER (SEGMENT MA34-04)

Location: Confluence with Deerfield River, Greenfield/Montague/Deerfield to Holyoke Dam, Holyoke/South Hadley.
Segment Length: 34.2 miles.
Classification: Class B, Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	66%
Agriculture	15%
Residential	9%

Mechanical harvesting of water chestnut (*Trapa natans*), a non-native invasive aquatic plant, was conducted in Log Pond Cove, Holyoke as part of the 2000 Connecticut River Watershed Water Chestnut Control Activities. Funds for the mechanical harvesting projects came from the Region 5 Challenge Cost Share Program, the EOEA, and Holyoke Water Power. Assistance in clearing the Log Pond Cove site was also provided by the Holyoke Department of Public Works. The Holyoke Conservation Department is overseeing the Log Pond Cove contract and work (Boettner 2000).

In addition to mechanical removal, Silvio Conte National Fish and Wildlife Refuge, under a grant from the National Fish and Wildlife Foundation has provided coordination for many hand-pulling events. Since early detection is key to control, EOEA, through the Franklin, Hampden, and Hampshire Conservation Districts, have hired an intern who is recruiting volunteers to actively check water bodies for the presence of water chestnut within the watershed of the mainstem of the Connecticut River. This “Invasive Plant Watch” program was made possible by a grant from the Riverways Program and the local conservation districts (Boettner 2000).

Seven reaches were used to organize water withdrawal and NPDES permitting information within this segment of the Connecticut River:

- Reach 04A: Confluence with Deerfield River downstream to confluence with the Sawmill River in Montague.
- Reach 04B: Confluence Sawmill River, Montague to confluence of Mill River in Hadley.
- Reach 04C: Connecticut River from confluence with Mill River-Hadley downstream to confluence with Mill River, Hatfield.
- Reach 04D: Confluence with Mill River-Hatfield downstream to confluence with Fort River, Hadley.
- Reach 04E: Connecticut River from confluence with Fort River downstream to the Oxbow in Northampton.
- Reach 04F: Connecticut River from Oxbow downstream to confluence with Bachelor Brook.
- Reach 04G: Connecticut River confluence with Bachelor Brook downstream to Holyoke Dam in Holyoke and South Hadley.

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID #	WMA Permit #	WMA Registration #	Authorized Average Withdrawal	1999 Average Withdrawal
Reach 04A: Confluence with Deerfield River downstream to confluence with the Sawmill River in Montague.					
Turners Falls Fire District, Montague	1192000-01G 1192000-02G 1192000-02S 1192000-03S	9P-1-06-192.01	1-06-192-01	1.040 MGD (reg) 0.120 MGD (per)	0.557 MGD 0.376 MGD 0 0
Montague Center Water District, Montague	1192001-01G				0.038 MGD
Deerfield Water District, Deerfield	1074000-02G Keats Spring				
DEM Lake Wyola Park & Campground, Shutesbury	1272001-01G				TNC (Transient non-community)
Camp Anderson Foundation, Wendell	1272003-01G				TNC
Red Wing Meadow Trout Hatchery, Montague		9P2-1-06-192.03	1-06-192-04	0.50 MGD (reg) 0.30 MGD (per)	0.72 MGD
Reach 04B: Confluence Sawmill River, Montague to confluence of Mill River in Hadley.					
South Deerfield Water Supply District, South Deerfield	1074001-01G	9P2-1-06-074.01	1-06-074-02	0.65 MGD*	0
Sunderland Water District, Sunderland	1289000-02G		1-06-289-05	0.24 MGD	0.34 MGD
Cliffside Apartments, Sunderland	1289001-01G 1289001-02G 1289001-03G				0.03 MGD
Pond Ridge Condo. Assn., Sunderland	1289002-01G				0.01 MGD
Reach 04C: Connecticut River from confluence with Mill River-Hadley downstream to confluence with Mill River, Hatfield.					
Hadley Highway & Water Dept., Hadley (Mt. Warner Wells)	1117002-01G 1117002-02G		1-06-117-02	0.79 MGD	0.403 MGD (01G) 0.341 MGD (02G)
Reach 04D: Confluence with Mill River-Hatfield downstream to confluence with Fort River, Hadley.					
Hadley Highway & Water Dept., Hadley (Callahan Wells)	1117002-03G 1117002-04G		1-06-117-02	0.79 MGD	0.001 MGD (03G) 0.0002 MGD (04G)
Reach 04E: Connecticut River from confluence with Fort River downstream to the Oxbow in Northampton.					
DEM Skinner State Park, Hadley	1117006-01G				0.002 MGD
Reach 04F: Connecticut River from Oxbow downstream to confluence with Bachelor Brook.					
Skinner State Park, Hadley	1117006-01G				TNC, no stats
South Hadley Fire District #1	1275000-01G	9P2-1-06-275.04			pending
South Hadley Fire District #2, South Hadley	1275001-04G		1-06-275-02	0.680 MGD	0.47
Reach 04G: Connecticut River confluence with Bachelor Brook downstream to Holyoke Dam in Holyoke and South Hadley.					
Holyoke Water Works, Holyoke	1137000-02S		1-06-137-11	Wtd from MA34-10	0 (emergency only)
Hazen Paper Company, Holyoke			1-06-137-01	.130 MGD	.036 MGD
Parsons Paper Co. Div. NVF, Holyoke			1-06-137-03	.590 MGD	.29 MGD
Wykoff Country Club, Holyoke			1-06-137-05	.040 MGD	.029 MGD
Sonoco Products Co., Holyoke			1-06-137-06	.850 MGD	.61 MGD
Holyoke Gas & Electric, Holyoke			1-06-137-08	.611 MGD	.173 MGD
Linweave Inc/Harris Energy & Realty, Holyoke			1-06-137-09	.716 MGD	Not in use in 1999
Mt. Tom Ski Area, Holyoke			1-06-137-10	1.130 MGD	Shut down
Kodak Polychrome Graphics – ANITEC, Holyoke		9P-1-06-137.01		.47 MGD	.25 MGD
Rexham Graphics, South Hadley			1-06-275-01	.200 MGD	0
South Hadley Golf Course, South Hadley		9P2-1-06-275.02			Not yet constructed
Total Withdrawals				*7.377 MGD*	*4.6762 MGD*

*Represents the pending permitted withdrawal for the entire system. 1074001-01G is designated as an emergency source only.

NPDES WASTEWATER DISCHARGE SUMMARY:

Reach 04A Confluence with Deerfield River downstream to confluence with Sawmill River in Montague. MA0100137 – Montague WPC (a conventional secondary treatment plant) is authorized to discharge 1.83 MGD to this segment of the Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity are LC 50 $\geq$ 50% effluent. Montague WPC average daily flow for 1999 was 1.06 MGD. The facility has had past problems with filamentous bacteria. The facility accepts septage, however its septage receiving station needs to be upgraded. Long-term concerns involve the development of a combined sewer overflow (CSO) control plan for the Towns' one CSO on Greenfield Road (McCollum 2000). The facility is also required to develop and implement an industrial pretreatment program. The current permit expires at midnight on 29 September 2000. See Table 6 for a summary of their toxicity testing report data.

MA0110051 – Bitzer Trout Hatchery is permitted to discharge 1.1MGD of fish raceway water to a tributary of the Connecticut River (Appendix C, Table C3). The average daily flow for 1999 was 1.39 MGD. The facility consists of fish raceways with four sedimentation basins to collect solids. Groundwater from springs is utilized for flow and is beyond the control of the operators. Their permit expired at midnight on 22 April 2000.

MA0000272 - B&M Railroad Yard, East Deerfield discharges boiler blowdown, cooling water, and wash water to the Connecticut River. The permit expired in 1980 and has been administratively continued (expired permit remains in effect until a new permit is issued). In 1999, there were three flow exceedances and two failures to monitor (McCollum 2000).

Reach 04B Confluence Sawmill River, Montague to confluence of Mill River in Hadley. MA0100218 – Amherst WWTP is a conventional secondary treatment plant that is permitted to discharge 7.1 MGD of treated municipal wastewater to the Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The Amherst WWTP average daily flow for 1999 was 4.4 MGD. The plant has consistently met its permit limits within the last three years. The permit expired midnight 30 September 2000 (McCollum 2000). (See Table 6 for a summary of their toxicity testing report data.)

MA0101648 – South Deerfield WWTP is an extended aeration plant capable of meeting secondary treatment standards. The facility is permitted to discharge0.85 MGD of municipal wastewater to Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. South Deerfield WWTP average daily flow for 1999 was 0.77 MGD. The plant has consistently met its permit limits within the last three years. The facility's major issue is correction of inflow and infiltration (McCollum 2000). The current permit expired midnight 29 September 2000. (See Table 6 for a summary of their toxicity testing report data.)

MA0101079 – Sunderland WWTP is an extended aeration plant permitted to discharge 0.5 MGD of municipal wastewater to the Connecticut River (Appendix C, Table C1). The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The facility's average daily flow for 1999 was 0.179 MGD. The facility has complied with its permit limits for the last three years. The only long-term issue is the closure of the on-site unlined sludge storage lagoon and the development of a long-term sludge disposal method. Currently the facility no longer utilizes the lagoon and is under Department Order to close it (McCollum 2000). The current NPDES permit expired midnight 29 September 2000. See Table 6 for a summary of their toxicity testing report data.

MA0101290 – Hatfield WWTP, a secondary treatment plant utilizing rotating biological contractors (RBCs), is permitted to discharge 0.5 MGD of treated municipal wastewater to the Connecticut River (Appendix C, Table C1). The WWTP does not have primary settling, which is normally typical of RBC plants. The average daily flow for 1999 was 0.224 MGD. The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The facility has consistently met its permit limits for the last three years. The only long-term issue for the town is to pursue removal of inflow and infiltration in its sewer system (McCollum 2000). The permit expired midnight 29 September 2000. (See Table 6 for a summary of their toxicity testing report data.)

Reach 04C - Connecticut River confluence with Mill River-Hadley to confluence with Mill River, Hatfield. None Identified

Reach 04D - Confluence with Mill River-Hatfield downstream to confluence with Fort River, Hadley.

MA0100099 – Hadley WWTP is a secondary treatment plant utilizing the extended aeration method for treatment and is permitted to discharge 0.54 MGD to the Connecticut River (Appendix C, Table C1). The average daily flow for 1999 was 0.332 MGD. The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The facility has consistently met its permit limits for the last three years (McCollum 2000). The permit expired midnight 29 September 2000. See Table 6 for a summary of their toxicity testing report data.

Reach 04E- Connecticut River from confluence with Fort River to the Oxbow in Northampton.

MA0101818 – The WWTP is a conventional secondary treatment plant permitted to discharge 8.6 MGD of treated municipal wastewater to the Connecticut River (Appendix C, Table C1). The average daily flow for 1999 was 4.63 MGD. The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The only long term concerns involve the facility experiencing some inflow and infiltration in the collection system, but the facility has meet permit limits in the last three years (McCollum 2000). The current permit expired midnight 29 September 2000. The facility will be required to develop and implement an industrial pretreatment program. (See Table 6 for a summary of their toxicity testing report data.)

Reach 04F - Connecticut River from Oxbow downstream to confluence with Bachelor Brook.

MA0101478 – Easthampton WWTP is a conventional secondary treatment plant permitted to discharge 3.8 MGD of treated sanitary and industrial wastewater to the Connecticut River via Outfall 001 and if necessary (higher flows) to the Manhan River via Outfall 002 (Appendix C, Table C1). Outfall 001 discharges to this segment of the Connecticut River approximately ¼ mile downstream of its confluence with Manhan River in Easthampton (near the Holyoke Corporate Boundary line). The permit limits for whole effluent toxicity are $LC_{50} \geq 100\%$ effluent. The average daily flow in 1999 was 2.6 MGD. The plant has consistently met its permit limits within the last three years (McCollum 2000). The facility will be required to develop and implement an industrial pretreatment program. The permit expired on 29 October 2000.

Reach 04G - Connecticut River confluence with Bachelor Brook o Holyoke Dam, Holyoke/South Hadley.

MA0005339 Northeast Utilities, Holyoke Water Power Company, Mount Tom Station is a steam generating power plant which uses coal as its primary fuel source (Appendix C. Table C2). The permit expired 18 September 1997 and has been administratively continued (expired permit remains in effect until a new permit is issued). The facility's monthly average flow for each outfall is summarized below:

001 – 133.2 MGD flow of once through non-contact cooling water. Chlorination is utilized for biofouling control. The permit limit for TRC is 0.15 mg/L, the maximum daily temperature limit is 39ºC, and the maximum daily temperature rise from the intake to the discharge (with both pumps operating) is 11.1ºC. Multi-unit chlorination is permitted.
002* – 0.216 MGD wastewater treatment plant effluent.
003, 004, 007, and 009a – stormwater runoff.
005 – 0.71 (normal maximum daily flow) of screen wash and service water tank overflow.
006 – 0.144 (maximum daily) of reflecting pool overflow.
008*, 009* – 0.25 MGD of bottom ash transport water (not used simultaneously).
010*, 011* – 1.0 MGD fly ash transport water (not used simultaneously).
*Required to monitor for Zinc and other metals. These outfalls currently discharge into unlined lagoons that then overflow to the Connecticut River.

[Note: Holyoke CSO Draft Environmental Impact Report (DEIR) was submitted for Massachusetts Environmental Policy Act Unit (MEPA) review on May 2000.

This DEIR identified zinc concentrations exceeding Class B on the Connecticut River, at the northern limits of the Holyoke Corporate Boundary.]

MA0101630 – The Holyoke combined sewage collection system has 15 active permitted CSO outfalls that discharge an estimated 517 million gallons per year (MGY) of untreated combined sewage into the Connecticut River (Appendix C, Table C1). The permit expired in October 2000. Five of these CSOs discharge to this segment of the Connecticut River. Holyoke's three largest CSOs cumulatively discharge an estimated 414 MGY to the Connecticut River. Two of these outfalls discharge to this segment: Outfall 021 discharging an estimated 58 MGY and CSO Outfall 018 discharging an estimated 65 MGY. The following five CSOs discharge into the Connecticut River at the end of this segment.

CSO Outfall 021 River Terrace
CSO Outfall 020 Cleveland Street
CSO Outfall 023 Jefferson Street (I-IV) to "Dingle" Drainage Ditch
CSO Outfall 019 Yale Street
CSO Outfall 018 Walnut Street

Reach 04G: Connecticut River confluence with Bachelor Brook to Holyoke Dam, Holyoke/South Hadley

FEDERAL ENERGY REGULATORY COMMISSION (FERC):

Project Name	Owner	Project #	Issue Date	Expiration Date	River	Kilowatts
Hadley Falls	Holyoke Water Power Company	2004	20 August 1999	31 August 2039	Connecticut River	45,675

The Holyoke Dam Hydroelectric Project is an operating FERC licensed facility located on the Connecticut River in the city of Holyoke and the town of South Hadley. A complete description of the facility is presented in Segment MA34-05.

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Ambient and effluent toxicity data were summarized (Table 6) for eight NPDES permitted facilities which submitted whole effluent toxicity reports to MA DEP DWM that discharge to this segment of the Connecticut River. These facilities submitted a total of 52 acute whole effluent toxicity testing results on tests which were conducted between May 1996 and May 2000. The Holyoke WPCF (which discharges to the next downstream segment of the Connecticut River MA34-05) also collects dilution water from this segment increasing the ambient toxicity dataset to 70.

Ambient

Survival of test organisms *C. dubia* and *P. promelas* exposed (48-hour) to Connecticut River water exceeded 75% in all but one test event.

Effluent

In 96% of the test events neither C. dubia nor P. promelas exhibited whole effluent acute toxicity. Hatfield WWTP's effluent was acutely toxic to C*. dubia* in two events in August 1996 and Easthampton WWTP's effluent was acutely toxic to C*. dubia* in one event in December 1996.

Table 6. Summary of TOXTD data: Connecticut River Segment MA34-03.

AMBIENT	River Flow	EFFLUENT
MONTAGUE WPCF – end of Poplar Street, near sandbar **Data set:** 5 tests May 1996 – May 1999 **Survival:** *C. dubia* 100% 48 hours **Suspended Solids:** < 5.0 – 52 mg/L **TRC:** not detected **pH:** 7.3 – 7.6 SU **Ammonia-nitrogen:** 0.03 – 0.10 mg/L **Hardness:** 23 – 40 mg/L		**MONTAGUE WPCF** – Outfall 001A **Data set:** 5 tests May 1996 – May 1999 LC_{50}**:** *C. dubia* ≥ 100% effluent. **TRC:** ≤0.03 mg/L **Ammonia-nitrogen:** 0.19 – 12 mg/L
SOUTH DEERFIELD WWTP – North of Sunderland Bridge **Data set:** 8 tests August 1996 – May 2000 **Survival:** *C. dubia* ≥95% 48 hours **Suspended Solids:** < 4.0 – 5.50 mg/L **TRC:** not detected **pH:** 6.7 – 7.5 SU **Ammonia-nitrogen:** 0.03 – 0.16 mg/L **Hardness:** 23 – 41 mg/L		**SOUTH DEERFIELD WWTP** – Outfall 001A **Data set:** 8 tests August 1996 – May 2000 LC_{50}**:** *C. dubia* ≥ 100% effluent **TRC:** ≤0.02 – 0.14 mg/L **Ammonia-nitrogen:** 0.06 – 8.1 mg/L
SUNDERLAND WWTF – off Old Amherst Rd (Riverside Cemetery) **Data set:** 4 tests each species *C. dubia* May 1997 – August 1998 *P. promelas* May 1997- May 2000 **Survival:** both species 100% 48 hours **Suspended Solids:** <4.0 – 11 mg/L **TRC:** not detected **pH:** 7.1 - 7.6 SU **Ammonia-nitrogen:** 0.05 – 9 mg/L **Hardness:** 30 – 72 mg/L		**SUNDERLAND WWTF** – Outfall 001 **Data set:** 4 tests each species *C. dubia* May 1997 – August 1998 *P. promelas* May 1997- May 2000 LC_{50}**:** *C. dubia* ≥ 100%, *P. promelas 72 - >100%* effluent **TRC:** ≤0.02– 0.1 mg/L **Ammonia-nitrogen:** <0.1 – 18 mg/L
AMHERST WWTP – 100 yd. Upstream of discharge **Data set:** 8 tests May 1996 to May 2000 **Survival:** *C. dubia* 100% at 48 hours **Suspended Solids:** not detected **TRC:** 0.01 – 0.05 mg/L **pH:** 6.8 - 7.9 SU **Ammonia-nitrogen:** <0.07 – 0.08 mg/L **Hardness:** 24 – 44 mg/L		**AMHERST WWTP** – Outfall 003B **Data set:** 8 tests May 1996 to May 2000 LC_{50}**:** *C. dubia* ≥ 100% effluent **TRC:** <0.01 – 0.05 mg/L **Ammonia-nitrogen:** 0.2 – 6.3 mg/L
HATFIELD WWTP – Approx. 500' upstream discharge **Data set:** 7 tests May 1996 – May 2000 **Survival:** *C. dubia* ≥95% 48 hours, *P. promelas* 55 – 100% (low survival in 1 of 7 tests) **Suspended Solids:** <5.0 – 5.5 mg/L **TRC:** <0.01 – 0.09 mg/L **pH:** 6.1 – 7.6 SU **Ammonia-nitrogen:** 0.07 – 17 mg/L **Hardness:** 32 – 76 mg/L		**HATFIELD WWTP** – Outfall 001 **Data set:** 7 tests May 1996 – May 2000 LC_{50}**:** *C. dubia* 9% - ≥ 100% effluent (2 acutely toxic events, both in August 1996), *P. promelas* 98 – >100% **TRC:** ≤0.01 – 0.12 mg/L **Ammonia-nitrogen:** 0.08 – 6.5 mg/L

Table 6. Continued. Summary of TOXTD data: Connecticut River Segment MA34-03.

AMBIENT	River Flow	EFFLUENT
HADLEY WWTP – Boat dock at 29 Honey Pot Rd **Data set:** 8 tests August 1996 – May 2000 **Survival:** *C. dubia* ≥95%, *P. promelas* 100% 48 hours **Suspended Solids:** < 4.0 – 10 mg/L **TRC:** not detected **pH:** 6.4 – 7.6 SU **Ammonia-nitrogen:** <0.01 – 0.17 mg/L **Hardness:** 22 – 38 mg/L		**HADLEY WWTP** – Outfall 001 **Data set:** 6 tests *C. dubia* May 1997 – May 2000, 4 tests *P. promelas* May 1997 – August 1998 LC_{50}**:** both species ≥ 100% effluent **TRC:** not detected **Ammonia-nitrogen:** 0.25 – 9.5 mg/L
NORTHAMPTON POTW – Approx. 300 yd. Upstream from outfall diffuser, upstream of Hockanum Rd. **Data set:** 9 tests May 1996 to May 2000 **Survival:** *C. dubia* ≥95% 48 hours **Suspended Solids:** < 5.0 – 19.50 mg/L **TRC:** 0.01 – 0.06 mg/L **pH:** 6.5 – 7.5 SU **Ammonia-nitrogen:** 0.05- 0.15 mg/L **Hardness:** 27 – 40 mg/L		**NORTHAMPTON POTW** – Outfall 001A **Data set:** 9 tests May 1996 to May 2000 LC_{50}**:** *C. dubia* ≥ 100% effluent **TRC:** 0.03 – 0.52 mg/L **Ammonia-nitrogen:** 3.1 mg/L – 26 mg/L
EASTHAMPTON WWTP – 15' upstream of discharge **Data set:** 5 tests June 1996 – December 1999 **Survival:** *C. dubia* ≥95% - 48 hours **Suspended Solids:** <5.0 – 9.0 mg/L **TRC:** 0.01 – 0.08 mg/L **pH:** 6.9 - 7.4 SU **Ammonia-nitrogen:** <0.07 - 0.14 mg/L		**EASTHAMPTON WWTP** – Outfall 001 **Data set:** 5 tests June 1996 – December 1999 LC_{50}**:** *C. dubia* 59.5% (Dec 1996) - > 100% effluent **TRC:** 0.05 - 0.16 mg/L **Ammonia-nitrogen:** 1.5 –7.0 mg/L
HOLYOKE WPCF - mile marker #17 on Route 5 **Data set:** 18 tests February 1996 – May 2000 **Survival:** *C. dubia* ≥95% - 48 hours **Suspended Solids:** <1.0 – 22.0 mg/L **TRC:** <0.02 – 0.04 mg/L **pH:** 6.7 - 7.8 SU **Ammonia-nitrogen:** <0.03 - 0.21 mg/L **Hardness:** 25 - 37 mg/L		**HOLYOKE WPCF** – in segment MA34-05

Chemistry – water

Ambient water chemistry sample results were summarized (Table 6) for eight NPDES permitted facilities which submitted whole effluent toxicity reports to MA DEP DWM and discharge to this segment of the Connecticut River. Seventy sampling events were conducted between February 1996 and May 2000.

pH

The instream pH ranged from 6.1 to 7.9 SU. Two measurements were <6.5 SU.

Suspended Solids

Suspended solids ranged between <1.0 and 52 mg/L with one only measurement was above 25 mg/L.

Ammonia-Nitrogen

Ammonia-Nitrogen ranged from <0.01 to 17 mg/L. Two measurements exceeded the instream chronic water quality criterion of 1.46 mg/L using the highest documented pH (7.9 SU).

Total Residual Chlorine

TRC exceeded 0.05 mg/L in two samples with a high value of 0.08 mg/L.

Hardness

Hardness ranged from 22 to 76 mg/L.

Chemistry - tissue

Results of the USGS NAWQA study documented elevated levels of total PCB in whole fish at four sampling stations along the mainstem Connecticut River which exceeded the NAS/NAE guidelines for the protection of fish-eating wildlife (Coles 1998). While this dataset however is limited to only one sample per station, the presence of PCB in fish throughout the entire mainstem Connecticut River (in MA), places the *Aquatic Life Use* on "Alert Status".

The *Aquatic Life Use* is assessed as supported for the upper 28.5 miles based on the above instream water chemistry and toxicity data. The lower 5.7-mile reach (from Mt. Tom Power Station to the end of the segment at the Holyoke Dam) is not assessed due to discharges from multiple CSOs and power plants. PCB contamination has also been identified as an issue of concern ("Alert Status") for this use.

FISH CONSUMPTION

MA DPH issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow), recommending that "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB (MA DPH 1999).

Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. Fish sampling for this project was initiated in 2000. This project is being managed by NEIWPCC and US EPA NERL. A summary of this project and its study objectives are presented in Appendix B.

Because of the MA DPH fish consumption advisory, the entire 34.2 miles of this segment do not support the *Fish Consumption Use*.

Connecticut River (Segment MA34-04) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life*		SUPPORT Upper 28.5 miles NOT ASSESSED Lower 5.7 miles		
Fish Consumption		NON SUPPORT	PCB contamination	Unknown
Primary Contact		NOT ASSESSED		
Secondary Contact		NOT ASSESSED		
Aesthetics		NOT ASSESSED		

**** "Alert Status"*** issues identified – details in Chemistry-tissue

RECOMMENDATIONS CONNECTICUT RIVER (SEGMENT MA34-04)

- Historically, elevated fecal coliform bacteria levels were documented in this segment of the Connecticut River. Monitoring of fecal coliform bacteria should be conducted under both wet and dry sampling conditions to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

- Review the results of the *Fish Tissue Testing in the Connecticut River* study developed by the Connecticut River Forum in 1999.

Point source

- Sunderland Water District, Sunderland (1289000-02G) 1-06-289-05 is permitted to withdraw 0.24 MGD while their actual withdrawal volume is 0.34 MGD. This facility is currently under investigation by MA DEP's Drinking Water Program. Continue to monitor and evaluate the current and projected water use of this facility.

- Montague WPC (MA0100137) long-term concerns involve the development of a combined sewer overflow (CSO) control plan for the Town's one CSO on Greenfield Road. The facility has had past problems with filamentous bacteria. The facility accepts septage, however its septage receiving station needs to be upgraded. The permit expired midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements.

- Bitzer Trout Hatchery permit (MA0110051) expired midnight 22 April 2000 and should be reissued with appropriate limits and monitoring requirements.

- B&M Railroad Yard permit (MA0000272) needs to be reissued with appropriate limits, stormwater runoff controls and monitoring requirements.

- Amherst WWTP permit (MA0100218) expires midnight 30 September 2000 and should be reissued with appropriate limits and monitoring requirements.

- South Deerfield WWTP (MA0101648) permit expires midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements. Inflow and infiltration problems should be corrected.

- Sunderland WWTP (MA0101079) permit expired midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements. A long-term sludge disposal method should be developed.

- Hatfield WWTP (MA0101290) permit expired midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements. The town should pursue the removal of inflow and infiltration in its sewer system.

- Hadley WWTP (MA0100099) permit expired midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements.

- Northampton WWTP (MA0101818) permit expired midnight 29 September 2000 and should be reissued with appropriate limits and monitoring requirements. Inflow and infiltration problems should be addressed.

- Easthampton WWTP (MA0101478) permit expired 29 October 2000 and should be reissued with appropriate limits and monitoring requirements.

- Northeast Utilities (MA0005339) – When the permit is reissued, EPA and MA DEP should consider including the # 2 fuel oil ground water remediation discharge now covered under an NPDES emergency exclusion; review conformance with the effluent guideline limits; and evaluate surface water/ ground water connections from the unlined settling basins. A 316 A & B analysis may be required during the next permit reissuance cycle (Keohane 2000). The permit should also be reissued with the following conditions: the high-pressure wash system should be changed to have both low and high pressure; chlorination should occur downstream of the screens; and there should be a fish return (Szal 2000).

- One particular issue of concern related to this facility is the use of chlorine to control biofouling in steam condenser tubes. Shortnose sturgeon, a federally endangered species, are reportedly attracted to thermal plumes and are also believed to be extremely sensitive to chlorine. The facility chlorinates once per day for two hours. Sensitive life stages of the sturgeon may be utilizing the

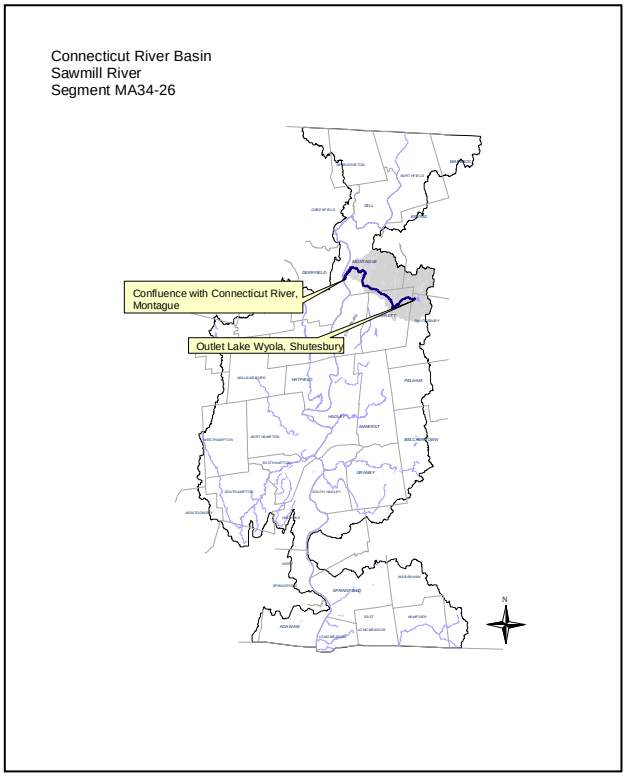
heated discharge plume as preferred habitat in the winter, and may be exposed to pulses of chlorine that may have a negative effect on them. Furthermore higher temperatures increase the metabolic rates of cold-blooded animals and would exacerbate the negative effects of chlorine. If sturgeon or other fish are preferentially using the thermal plume, dechlorination should be considered. Studies designed to 1) characterize the species utilizing the thermal plume as habitat throughout the year, 2) to evaluate entrainment and impingement effects and 3) reevaluate the thermal plume should also be considered (Szal 2000).

Combined Sewer Overflows:

- Holyoke will be required to implement "9 Minimum Controls" as a condition of their new NPDES permit as well as to develop a long-range control plan to address abatement of impacts related to CSOs (Hogan 2000). Holyoke's four overflows upstream of the Dam are of significant concern to MA DEP. Since swimming areas have been identified in the Facilities Plan and MA DFWELE has also raised concerns about impacts to fish passage at and near the Dam, MA DEP and EPA will scrutinize CSO controls very carefully in this area as a result. Depending on the results of the Final CSO plan, the SWQS will need to be updated. If any CSO discharges are to remain, then a B (CSO) designation would be necessary (Brander 2000).

SAWMILL RIVER (SEGMENT MA34-26)

Location: Outlet Lake Wyola, Shutesbury to the confluence with the Connecticut River, Montague.
Segment Length: 13.0 miles.
Classification: Class B.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	85%
Agriculture	6%
Residential	5%

Spaulding Dam is located on the Sawmill River at Spaulding Brook Road, Montague. On 31 March 2000 a proposal was submitted to the EOEA Connecticut Team for construction of a fish passage around the dam. The site offers a potential for natural fish diversion around the dam. The project is sponsored by Trout Unlimited, Deerfield/Millers Chapter (McCollum 2000).

In 1993 DWM conducted an instream (upstream/downstream) RBP II and V evaluation of the Red Wing Meadow Trout Hatchery discharge. No adverse impacts to either the benthic macroinvertebrate or the fish communities were documented (MA DEP 1995).

As part of the Anadromous Fish Restoration Project, Massachusetts Division of Fisheries and Wildlife personnel have been releasing hatchery reared salmon fry into the Sawmill River. Fry are bulk transported from either the Roger Reed Hatchery or White River National Salmon Hatchery, enumerated, and transferred by weight to 19-liter plastic pails filled with river water. They are then stocked using the scatter-plant method. Over the last six years a total of 440,638 salmon fry have been planted into the Sawmill River with 61,158 salmon fry stocked in 1999 (Slater 2000).

WATER WITHDRAWAL SUMMARY:

Facility	**PWS ID#**	**WMA Permit #**	**WMA Registration #**	**Authorized Withdrawal**	**1999 Average Withdrawal**
Turners Falls Fire District, Montague	1192000-01G 1192000-02G 1192000-02S 1192000-03S	9P-1-06-192.01	1-06-192-01	1.040 MGD (reg) 0.120 MGD (per)	0.557 MGD 0.376 MGD 0 0
Montague Center Water District, Montague	1192001-01G				0.038 MGD
DEM Lake Wyola Park & Camp-ground, Shutesbury	1272001-01G				TNC (Transient non-community)
Camp Anderson Foundation, Wendell	1272003-01G				TNC
Red Wing Meadow Trout Hatchery, Montague		9P2-1-06-192.03	1-06-192-04	0.50 MGD (reg) 0.30 MGD (per)	0.72 MGD
Total withdrawals				*1.96 MGD*	*1.691 MGD*

NPDES WASTEWATER DISCHARGE SUMMARY:
MA0027880 – Redwing Meadow Trout Hatchery is permitted to discharge 1.44MGD of fish rearing water to the Sawmill River (Appendix C, Table C3). The facility's treatment consists of two sedimentation ponds in series. Although the permit expired midnight 22 April 2000, the facility had reapplied for the permit and will continue to operate under the expired permit until such time as the new permit is issued. The facility's average daily flow for 1999 was 0.74 MGD (McCollum 2000). The facility has consistently met its permit limits for the last three years.

USE ASSESSMENT
Current data/information was not available therefore all uses for Sawmill River (Segment MA34-26) are not assessed.

Sawmill River (Segment MA34-26) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

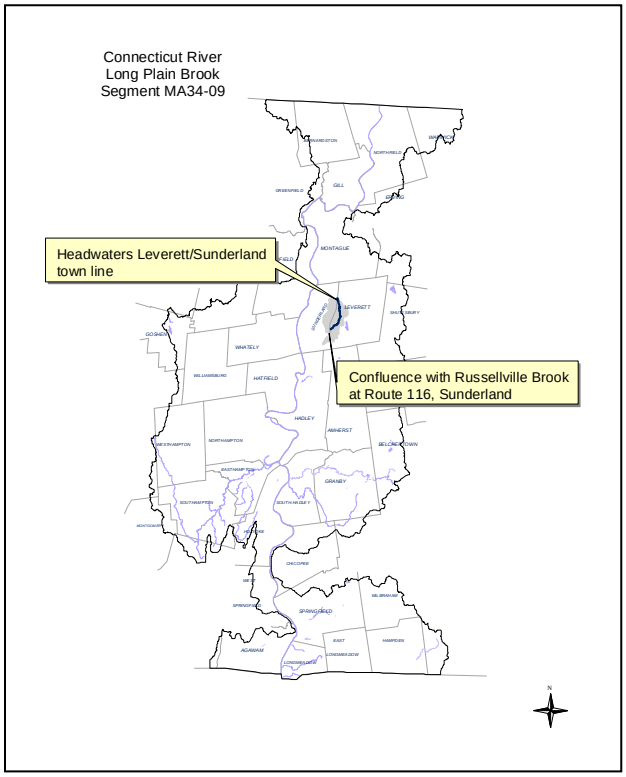
- As a result of the 1993 DWM upstream/downstream evaluation of the Red Wing Meadow Trout Hatchery discharge, the classification of this stream as a cold water fishery was recommended. In consultation with DFWELE consider the classification of this stream as a cold water fishery.

LONG PLAIN BROOK (SEGMENT MA34-09)

Location: Headwaters, Leverett/Sunderland town line to confluence with Russellville Brook at Rt. 116, Sunderland.
Segment Length: 3.5 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	84%
Agriculture	7%
Open Land	4%



USE ASSESSMENT

Current data/information was not available therefore all uses for Long Plain Brook (Segment MA34-09) are not assessed.

Long Plain Brook (Segment MA34-09) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

MILL RIVER-HADLEY (SEGMENT MA34-25)

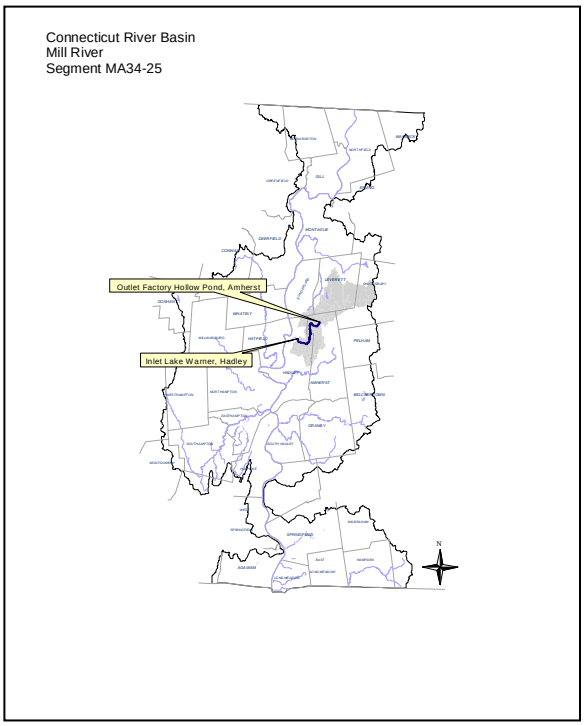
Location: Outlet of Factory Hollow Pond, Amherst to the inlet of Lake Warner, Hadley.
Segment Length: 5. 2 miles.
Classification: Class B.

[Note: downstream of Lake Warner is the unnamed tributary Segment MA34-31]

As part of the "Invasive Plant Watch" program made possible by a grant from the Riverways Program and the local Conservation Districts, *Trapa natans* was identified and removed from Lake Warner in Hadley (Boettner 2000).

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	60%
Agriculture	17%
Residential	11%



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Amherst DPW Water Div., Amherst	1008000-01S	9P-1-06-008.01	1-06-008-02	1.25 MGD*	1.03 MGD
Hadley Highway & Water Dept., Hadley	1117002-01G 1117002-02G		1-06-117.02	0.79 MGD	0.63 MGD
Leverett Elementary School, Leverett	1154001-01G				0.0007 MGD
Hampshire Franklin Children Day Center, Leverett	1154004-01G				0.0002 MGD
Shutesbury Elem. School, Shutesbury	1272002-01G 1272002-02G				0.0004 MGD
Total Withdrawals				*2.04 MGD*	*1.66 MGD*

* Represents the safe yield determined for this source, the Atkins Reservoir. Total authorized system withdrawal is 4.25 MGD.

NPDES WASTEWATER DISCHARGE SUMMARY:

Note: Although the Amherst WWTP is located along this segment, the actual discharge point is to the mainstem Connecticut River (segment MA34-04).

USE ASSESSMENT

Current data/information was not available therefore all uses for Mill River-Hadley (Segment MA34-25) are not assessed.

Mill River-Hadley (Segment MA34-25) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

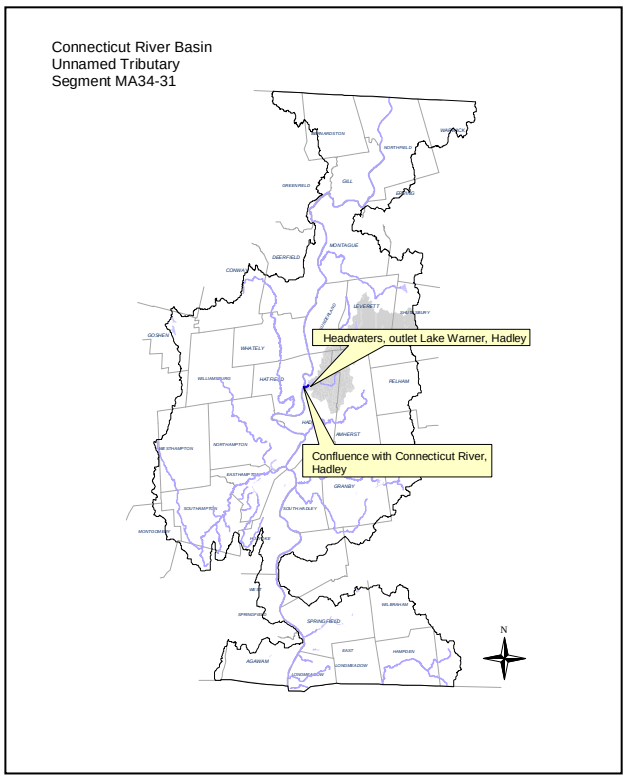
UNNAMED TRIBUTARY (SEGMENT MA34-31)

Location: Headwaters, outlet Lake Warner, Hadley to the confluence with the Connecticut River, Hadley.
Segment Length: 0.5 miles.
Classification: Class B.

As part of the "Invasive Plant Watch" program made possible by a grant from the Riverways Program and the local Conservation Districts, *T. natans* was identified and removed from Lake Warner in Hadley (Boettner 2000).

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	58%
Agriculture	19%
Residential	11%



USE ASSESSMENT

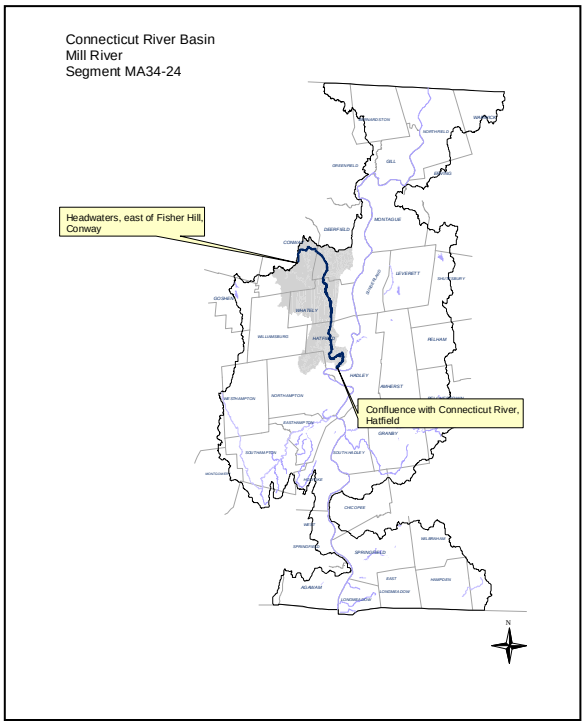
Current data/information was not available therefore all uses for Unnamed Tributary (Segment MA34-31) are not assessed.

Unnamed Tributary (Segment MA34-31) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

MILL RIVER-HATFIELD (SEGMENT MA34-24)

Location: Headwaters, north of Route 116, Conway to the confluence with the Connecticut River, Hatfield.
Segment Length: 24.6 miles.
Classification: Class B.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	70%
Agriculture	17%
Residential	7%

The Mill River-Hatfield system is located in Conway, Deerfield, Whately, Hatfield, Williamsburg, and Northampton. The Mill River-Hatfield has five main tributaries, two of which have water supply reservoirs. Two of the streams (West Brook and Roaring Brook) experience no-flow conditions during dry periods (Pioneer Valley Planning Commission 1999). Running Gutter comes physically close to Mountain Street Reservoir, but actually flows through Beaver Brook to the Mill River-Northampton. The other two tributaries flow into the Mill River-Hatfield from the east over the flat bed of Glacial Lake Hitchcock. According to the Clark Science Center, water quality is poor in those tributaries (Clark Science Center 2000). Water withdrawn from the reservoirs is discharged out of the Mill River-Hatfield watershed.

Assessing the impact of human activity within the Mill River-Hatfield system is an essential aspect of the Smith College interdisciplinary pilot study (Clark Science Center 2000). Although the northwestern portions of the watershed are rural and forested, a significant percentage of the system is influenced by adjacent agricultural land, residential and commercial development, channelization, and the Interstate 91 corridor. The disruption of habitat and vegetation, and the influence of run-off on water quality pose fundamental threats to the ecological viability of this system. The ability to compare more rural areas of the watershed to those undergoing agriculture or suburbanization provides an excellent opportunity to understand human impact on natural populations and communities. The research contributes to more informed management and policy decisions as they relate to the future of the Mill River-Hatfield subwatershed system.

The Mill River-Hatfield is represented by an active watershed group led by Scott Jackson of the UMass Extension Service. The group has identified a number of issues within the watershed that are currently being addressed. Projects underway are bank stabilization (Appendix A, Project 99-08/319 Mill River Watershed Restoration Project) in Whately (where erosion of the river bank has threatened the Whately Public Water Supply Well) and the installation of a monitoring well. The presence of an endangered fresh water mussel has complicated the permitting of the in-stream work (McCollum 2000).

The Hatfield Dam has been rated by the Dam Safety Office of the Department of Environmental Management as at risk of failure. A search for monies to study the impacts of breaching or repairing and upgrading the dam with a fish ladder is underway. Breaching the dam will result in the loss of many acres of wetland habitat especially for the endangered fresh water mussels.

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Conway Grammar School, Conway	1068006-01G				0.00076 MGD
South Deerfield Water Supply District, South Deerfield	1074001-01S 1074001-02S	9P2-1-06-074.01	1-06-074-02	0.65 MGD	0.74 MGD (01S and 02S)
Northampton Water Supply District, Northampton	1214000-03S 1214000-04S	9P2-01-06-214.01	1-06-214-01	3.96 MGD	1.66 MGD (03S) 0 MGD (04S)
Whately Water District, Whately	1337000-01G 1337000-02G				0.010 MGD (01G) 0 MGD (02G)
Whately Water Department, Whately	1337010-01G 1337010-02G				0.002 MGD (01G) 0.077MGD (02G)
Hatfield Water Department, Hatfield	1127000-01G 1127000-02G 1127000-01S		1-06-127-02	0.35 MGD	0.11 MGD (01G) 0.06 MGD (02G) 0.25 MGD (01S)
Total Withdrawals				*4.96 MGD*	*2.91 MGD*

The South Deerfield Water District has applied to MA DEP to increase its water withdrawal rate to more accurately reflect its present day usage. The permit application was deficient in submitting information that discusses impacts on the river, conservation measures, and alternative sources. The South Deerfield Water District signed an Administrative Consent Order with MA DEP to quantify water use and perform a hydrologic study of the stream from which the district withdraws water. Smith College and UMass researchers are also performing ecological assessments of the stream (McCollum 2000).

NPDES WASTEWATER DISCHARGE SUMMARY:

None

USE ASSESSMENT

AQUATIC LIFE

Biology

Fish Population

As part of the Smith College multiyear interdisciplinary program fish diversity investigations were conducted in the Mill River-Hatfield in 1997-1998. A total of 22 species were documented in 1998 five more than the 1997 field investigations (Environmental Science and Policy Program 1999).

Tessellated darters, the host fish for the federally endangered dwarf wedge mussel, were observed in four locations in the mainstem Mill River-Hatfield, and were common in one location (McLain 2000).

As part of the Anadromous Fish Restoration Project, Massachusetts Division of Fisheries and Wildlife personnel have been releasing hatchery reared salmon fry into the Mill River-Hatfield. Fry are transported in bulk from either the Roger Reed Hatchery or White River National Salmon Hatchery, enumerated, and transferred by weight to 19-liter plastic pails filled with river water. They are then stocked using the scatter-plant method. West Brook, a tributary to the Mill River-Hatfield was stocked with 13,665 salmon fry in 1999. Since 1987 approximately 0.3 million salmon fry have been planted in the Mill River-Hatfield and its tributaries (Slater 2000).

Habitat/Flow

An impassable dam in Hatfield limits the distribution of two species of mussels, alewife floater *(Anodonta implicata*) and triangle floater (*Alasmidonta undulata*). However, the dam may also help protect the dwarf wedgemussel by blocking predatory fish that prey on tessellated darters. Dwarf wedgemussels rely on a high density of darters for successful reproduction. Piscivorous fish

predators were largely absent from areas with high density of dwarf wedgemussel (McLain 2000). Both darters and dwarf wedgemussels were rare in deep pools (>1m at low flow).

Other

The mainstem of the Mill River-Hatfield contains one of the more significant, viable populations of the dwarf wedgemussel *(Alasmidonta heterodon)* in the United States (Clark Science Center 2000). This wedgemussel is on the Federal Endangered Species List. The Mill River-Hatfield has the highest diversity of mussels in Massachusetts and is equal with the Mill River-Northampton with a species richness of nine. The only known viable population of dwarf wedgemussels in the state is in the Mill River-Hatfield with an estimated population between 500 and 1000 individuals. Additionally small populations of dwarf wedgemussels are locally found in Broad Brook and Running Gutter. Reproduction is also strongly related to mussel density. Little reproduction was detected in areas with low density of dwarf wedgemussels.

Mark-recapture studies of the tessellated darter in the Mill River-Hatfield showed extremely limited dispersal capacity for encysted *glochidia*. The results indicate that natural expansion of the population is a slow process. The population is vulnerable due to its small size and concentrated distribution. Broad Brook and Running Gutter may serve as a refuge separate from the Mill River-Hatfield (McLain 2000).

The dynamics of beaver activity in the Mill River-Hatfield also influences the distribution of mussels. Mussel species composition changes abruptly at beaver dams. While the dwarf wedgemussel may be adversely affected, the eastern pond mussel becomes more abundant above beaver dams in the Mill River-Hatfield. Since the distribution of dwarf wedgemussels is concentrated in a 1-km stretch, beaver activity in that area could threaten the integrity of the population. In Broad Brook and Running Gutter however, beaver dams trap sediment and provide habitat for dwarf wedgemussels (McLain 2000).

The Mill River-Hatfield also supports three state listed mussels, all 'Special Concern': eastern pond mussel (*Ligumia nasuta*), triangle floater (*Alasmidonta undulata*), creeper (*Strophitus undulatus*). Other state listed species identified in the Mill River-Hatfield include: two dragonflies (zebra clubtail - *Stylurus scudderi* and brook snaketail - *Ophiogomphus aspersus*), wood turtle (*Clemys insculpta*) and two plants (McLain 2000). Since mussels are excellent bio-indicators of water quality, the Mill River-Hatfield study provides not only the opportunity to better understand the problems of an endangered species, but also the larger watershed system that it inhabits.

Chemistry – water

pH

As part of the Smith College multiyear interdisciplinary program 56 water quality samples were collected from the Mill River -Hatfield (near its confluence with the Connecticut River in Hatfield) between 26 May 1997 and 11 October 1999. The average pH during this time period was 7.19 $\pm$0.28 standard deviations (Stone 1999).

The *Aquatic Life Use* is supported in this river based on the above biological data/information (presence of endangered species, high fish diversity, etc.).

AESTHETICS

The Mill River Stream Team conducted a shoreline of the Mill River-Hatfield in September 1999 (Mill River Stream Team 1999). The survey began at the headwaters of the Mill River in Conway and continued through Deerfield, downstream to its confluence with West Brook in Whately. Shoreline survey notes indicate that with the exception of the very headwaters (murky water below Fisher Road) the Mill River-Hatfield was clear and fast flowing and described as excellent trout habitat. Localized areas of trash and debris in this reach of the Mill River-Hatfield were also identified placing this segment of "Alert Status".

The *Aesthetics Use* is supported in the Mill River-Hatfield. Additionally the segment is placed on "Alert Status" due to localized areas of trash and debris.

Mill River-Hatfield (Segment MA34-24) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life		SUPPORT		
Fish Consumption		NOT ASSESSED		
Primary Contact		NOT ASSESSED		
Secondary Contact		NOT ASSESSED		
Aesthetics*		SUPPORT		

***** **"*Alert Status*"** issues identified – details in Aesthetics

RECOMMENDATIONS MILL RIVER-HATFIELD (SEGMENT MA34-24)

- Mill River–Hatfield supports populations of a federally listed endangered species and several state listed species of special concern. The Mill River-Hatfield has five main tributaries, two of which have water supply reservoirs. Surface and groundwater is withdrawn from this subwatershed by six public water supplies. Major issues under consideration in this subwatershed include water withdrawal permits and dam safety decisions. The Connecticut River Initiative and Strategic Plan recommended the use of the Mill River-Hatfield as a case study to identify ecologically-based streamflow requirements and to develop an approach to determine ecological thresholds for streamflows that can be used elsewhere (Pioneer Valley Planning Commission 1999).

- Review the data submitted by the South Deerfield Water District as required by the Administrative Consent Order and issue permit decision.

- The Hatfield Dam has been rated by the Dam Safety group of DEM as at risk of failure. A search for monies to study the impacts of breaching or repairing and upgrading the dam with a fish ladder is underway. Breaching the dam will result in the loss of many acres of wetland habitat especially for the endangered fresh water mussels. The dam also limits the distribution of two species of mussels. Evaluation of the long-term effects on this ecosystem must preclude any dam repair/removal activities.

- Conduct a Mill River Stream Team cleanup to remove trash and debris.

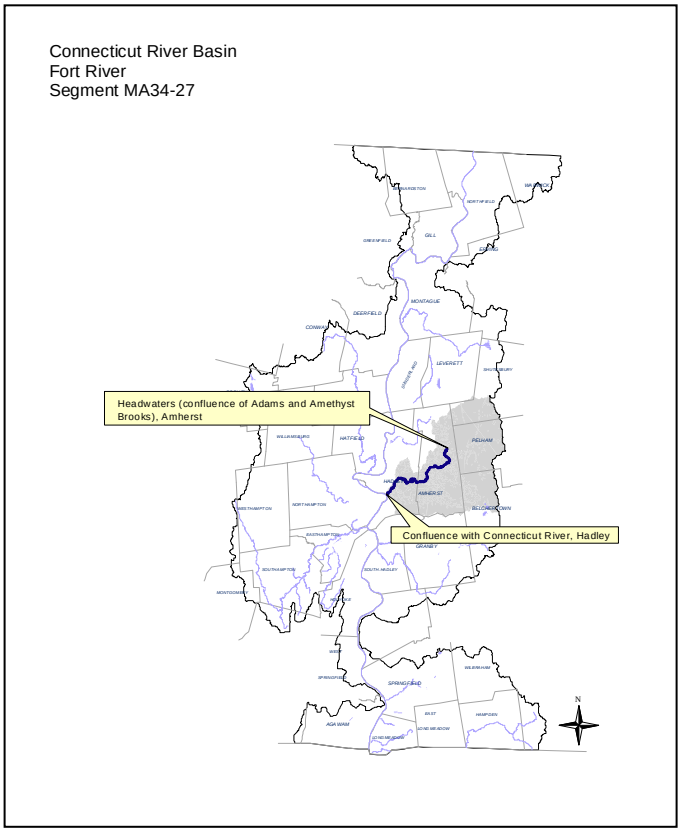
- Evaluate the effectiveness of the streambank stabilization Project (99-08/319 Mill River Watershed Restoration Project) in Whately (Appendix A).

FORT RIVER (SEGMENT MA34-27)

Location: Headwaters (confluence of Adams and Amethyst Brooks), Amherst to the confluence with the Connecticut River, Hadley.
Segment Length: 12.8 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	67%
Agriculture	16%
Residential	10%



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Amherst DPW Water Div., Amherst	1008000-02S 1008000-01G 1008000-04G 1008000-02G 1008000-05G 1008000-06G 1008000-07G	9P-1-06-008.01	1-06-008-02	4.25 MGD*	0.982 MGD (02S) 0.48 MGD (01&04G) 0.989 MGD (02G) 0.298 MGD (05G) 0.062 MGD (06G) 0 (07G)
DEM Notch Visitors Center, Amherst	1008006-01G				0.0005 MGD
Belchertown Water District, Belchertown	1024000-05G	9P-1-06-024.01		0.15 MGD	0.20 MGD
Cedarwood Apartments, Belchertown	1024009-01G				0.002 MGD
Total Withdrawals				*4.4 MGD*	*3.01 MGD*

* Represents the total authorized system withdrawal.

NPDES WASTEWATER DISCHARGE SUMMARY:

MA032689 University of Massachusetts Coal Storage and Handling facility, Amherst discharges treated stormwater to an unnamed tributary (locally known as "Taylor Brook") which discharges into Adams Brook, a tributary of the Fort River (Appendix C, Table C2). The facility has permit limits for TSS, oil and grease and pH and is also required to monitor whole effluent toxicity and several metals (Cu, Zn, Ni, and Al). In 1999 monitoring was not conducted. pH was violated on one occasion in 1999. The effluent exhibited some acute toxicity in one of four test events (LC_{50} >100% and ANOEC = 50% effluent). The permit expired in 1999 and has been administratively continued (expired permit remains in effect until a new permit is issued).

USE ASSESSMENT

Current data/information was not available therefore all uses for Fort River (Segment MA34-27) are not assessed.

Fort River (Segment MA34-27) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

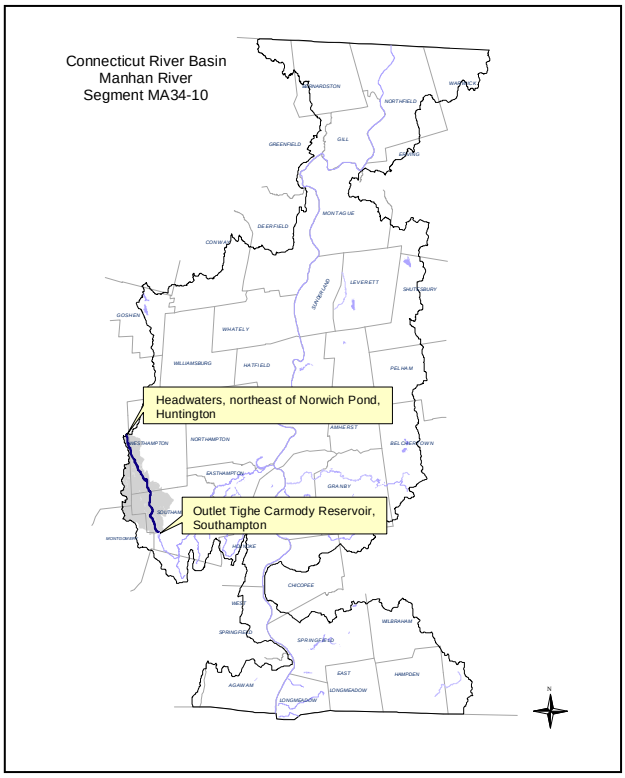
- Reissue UMass Coal Storage and Handling Facility NPDES permit MA032689 with appropriate permit limits and requirements.

MANHAN RIVER (SEGMENT MA34-10)

Location: Headwaters, (northeast of Norwich Pond) Huntington to outlet Tighe Carmody Reservoir, Southampton.
Segment Length: 15.2 miles.
Classification: Class A.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	91%
Agriculture	1%
Wetlands	1%



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Holyoke Water Works, Holyoke	1137000-04S 1137000-05S		1-06-137-11	8.040 MGD	6.49MGD (05S), (04S) active, no meter
Total Withdrawals				*8.040 MGD*	*6.49 MGD*

USE ASSESSMENT

Current data/information was not available therefore all uses for Manhan River (Segment MA34-10) are not assessed.

Manhan River (Segment MA34-10) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

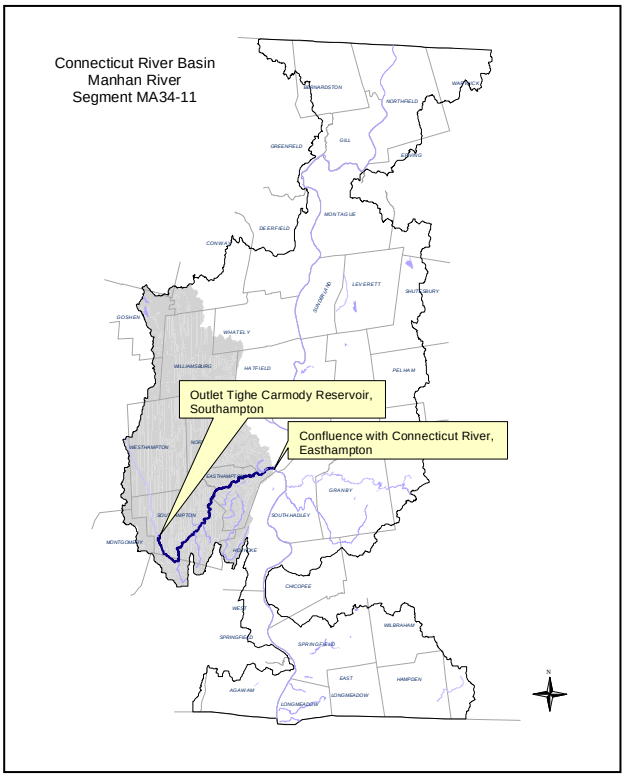
MANHAN RIVER (SEGMENT MA34-11)

Location: outlet Tighe Carmody Reservoir, Southampton to confluence with Connecticut River, Easthampton.
Segment Length: 10.9 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	73%
Agriculture	11%
Residential	9%

[NOTE: Fisheries – The North Branch Manhan River and its tributary Sodom Brook (tributaries to this segment of the Manhan River) are stocked with salmon fry by the Massachusetts Division of Fisheries and Wildlife as part of the ongoing Atlantic Salmon Restoration Program (Slater 2000).]



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Easthampton Water Department, Easthampton	1087000 04G 1087000 05G 1087000 06G 1087000 07G 1087000 08G 1087000 09G	9P2-1-06-087.01	1-06-087-01	3.310	0.66 (04G) 0.098 (05G) 0.05 (07G) 1.08 (08G) see footnotes
Holyoke Water Works, Holyoke	1137000 02G		1-06-137-11	8.040	0 (02G inactive)
Mt. View Nursing Home, Montgomery	1194001 01G				0.0018 MGD
Southampton Water Department, Southampton	1276000 01G	9P2-1-06-276.01	1-06-276-01	0.110	0.10 MGD
CT Valley Biological Lab, Southampton	1276005 01G				No meter
White Oak School, Westfield	1329004 01G				0.0005 MGD
Hampshire Regional High School, Westhampton	1331003 01G				0.002 MGD
Windy Acres Campground, Westhampton	1331004 01G				TNC (Transient non-community), no info
Westhampton Elementary School, Westhampton	1331007 01G				0.0005 MGD
Total Withdrawals				*11.46*	*1.9928 MGD*

NOTES: Easthampton withdrawal for 04G/05G blend @ treatment plant was 312,931,000 gals/year; reported total for individual wells was 276,128. 1999average withdrawal shown above is based on individual well reports. Easthampton well 06G is for emergency use only. Well 09G is new, under construction in 1999. Montgomery's Mountain View Nursing Home statistical report shows wells 02G and 03G are combined assumed into 01G.

NPDES WASTEWATER DISCHARGE SUMMARY:

MA0101478 – Easthampton WWTP is a conventional secondary treatment plant (Appendix C, Table C1). The facility usually discharges to the Connecticut River via Outfall 001, however whenever the flow exceeds the permitted discharge to the Connecticut River the excess flow discharges to the Manhan River via Outfall 002 (McCollum 2000). Outfall 002 discharges to the Manhan River approximately one mile upstream of its confluence with the "Oxbow" in Easthampton. The discharge to the Manhan River (002) is dechlorinated.

USE ASSESSMENT

Current data/information was not available therefore all uses for Manhan River (Segment MA34-11) are not assessed.

Manhan River (Segment MA34-11) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

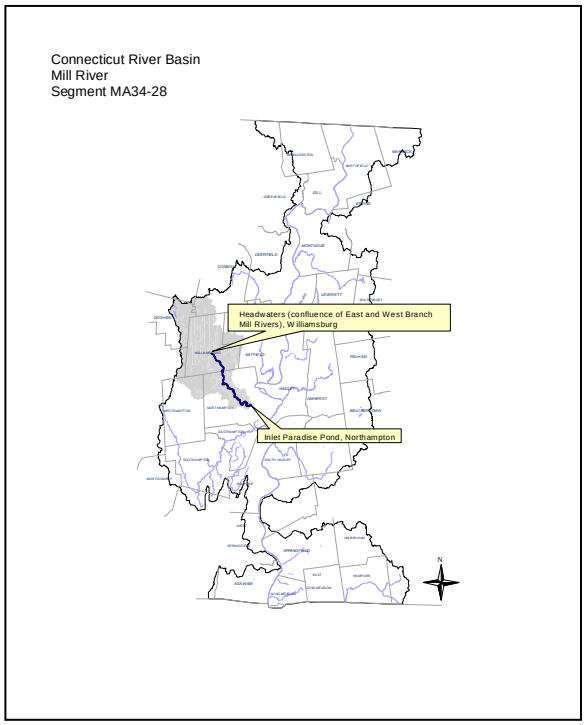
MILL RIVER-NORTHAMPTON (SEGMENT MA34-28)

Location: Headwaters (confluence of East and West Branch Mill River), Williamsburg to the inlet of Paradise Pond, Northampton.
Segment Length: 9.6 miles.
Classification: Class B.

[Note: downstream from Paradise Pond, in the Mill River Diversion, segment MA34-32]

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	80%
Residential	8%
Agriculture	7%



As part of the Anadromous Fish Restoration Project, Massachusetts Division of Fisheries and Wildlife personnel have been releasing hatchery reared salmon fry into the Mill River-Northampton. Fry are bulk transported from either the Roger Reed Hatchery or White River National Salmon Hatchery, enumerated, and transferred by weight to 19-liter plastic pails filled with river water. They are then stocked using the scatter-plant method. The East and West branches of the Mill River-Northampton have been stocked with salmon fry since 1997 (Slater 2000).

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Goshen Center School Goshen	1108003-01G				No Data
4H Camp Howe Inc., Goshen	1108008-02G				0.003 MGD
DEM DAR State Forest, Goshen	1108010-02G 1108010-03G				0.0009 MGD
Northampton Water Department, Northampton*	1214000-01G 1214000-02G 1214000-01S 1214000-02S	9P2-01-06-214.01	1-06-214-01	3.96 (reg) 0.84 (per) MGD	0.107 MGD (01G) 0.098 MGD (02G) 2.02 MGD (01S) 0 (02S)
Linda Manor Nursing Home, Leeds	1214001-01G 1214001-02G				0.013 MGD
Williamsburg Water Department, Haydenville	1340000-01G 1340000-02G 1340000-01S		1-06-340-01	0.2 MGD	0.22 MGD
Total Withdrawals				*5.00 MGD*	*2.46 MGD*

NOTES: * Northampton's Ryan and Whately Reservoirs (#1214000-03S and 1241000-04S) are included in the authorized withdrawal even though they are in the CT river segment MA34-30.

NPDES WASTEWATER DISCHARGE SUMMARY:

Techalloy-Northampton (MA0004235) is permitted to discharge 100,000 GPD of noncontact cooling water as well as treated wastewater (acid-rinse) to the Mill River-Northampton. The permit expired in 1991 and has been administratively continued (expired permit remains in effect until a new permit is issued). In 1999 the facility had 23 exceedances of their permit limits including copper, nickel, and TSS (McCollum 2000). MA DEP has recently concluded negotiations for an Administrative Consent Order Penalty with the company ($32,878 with stipulations for non-compliance). As an interim measure, the company has tied its discharge into the Northampton Sewer Collection System (McElroy 2000).

Perstorp Compounds, Inc. (MAG250960) Northampton has a general NPDES permit to discharge non-contact cooling water to the Mill River-Northampton. The facility's individual permit (MA0027146) was closed and a general permit was issued in March 1996. The facility had four pH exceedances in 1999.

USE ASSESSMENT

AQUATIC LIFE USE

Chemistry – tissue

The USGS collected fish from one station on the Mill River-Northampton near the USGS gage, Northampton as part of their NAWQA study. Both the concentration of PCB (190 PPM) and DDT (170 PPM) in the whole fish composite sample were below the NAS/NAE guidelines for the protection of fish-eating wildlife (Coles 1996). The total chlordane concentration (130 PPM) exceeded the NAS/NAE guidelines.

Chemistry – sediment

USGS as part of their NAWQA study, analyzed sediment collected from the Mill River-Northampton near the USGS gage, Northampton. The concentration of total PCB was 86 PPM, above the S-EL guidelines (Harris 1997). This sediment sample was comprised primarily of sand (89%) and silt (10%) while the total organic carbon (TOC) was 5.68%. Cadmium (1.1 PPM), copper (120 PPM), lead (160 PPM), nickel (57 PPM) and zinc (360 PPM) exceeded the L-EL guidelines while mercury (0.2 PPM) was at the L-EL (Persaud *et al*.1993). Chromium (130 PPM), iron (4.7%), and manganese (1900 PPM) exceeded the S-EL guideline.

*Note: The S-EL guideline for PCB varies depending on the total organic carbon content (TOC) in the sample. Results have been summarized above using a conservative TOC estimate of 1% (where the S-EL = 5.3 PPM) and the maximum guidance allowable TOC of 10% (where the S-EL = 53 PPM).

Too little current instream data/information was available to assess the *Aquatic Life Use* for the Mill River-Northampton. However, elevated levels of chlordane in whole fish and trace elements and PCB in sediment have been identified as issues of concern ("Alert Status"). Data was not available to assess any of the other uses.

Mill River-Northampton (Segment MA34-28) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

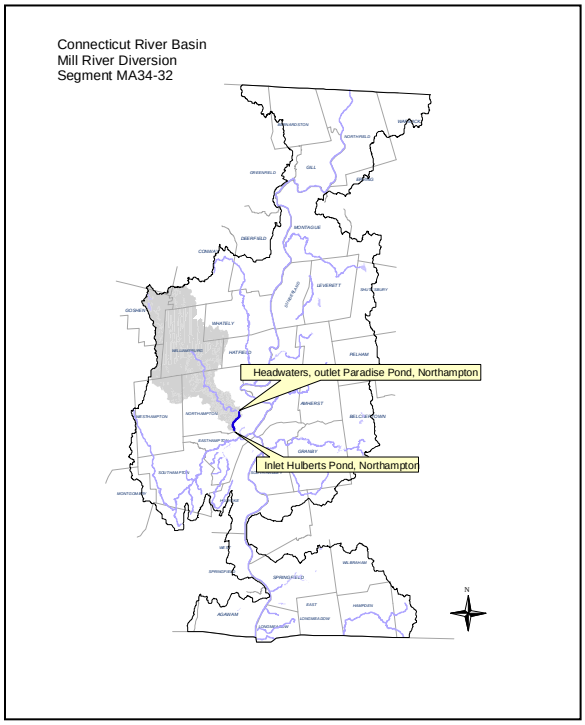
- Techalloy-Northampton's (MA0004235) NPDES discharge has been tied into the Northampton Sewer Collection System (McElroy 2000). Techalloy has worked with an engineer to increase the efficiency of their existing wastewater treatment facility, and is looking to eventually install a zero discharge system for their wastewater (100% recycle/recover/re-use). Continue to evaluate the effectiveness of the facility updates specifically emphasizing reduction/elimination of metal contaminants.

- Elevated levels of metals in sediment and chlordane in whole fish tissue have been documented downstream from Techalloy-Northampton's discharge. Additional monitoring in the Mill River-Northampton is warranted.

- MAG250960 Perstorp Compounds, Inc. Northampton permit expired in May 1999. An individual permit with appropriate monitoring requirements and limits (including toxicity testing) should be developed because of pH exceedances.

MILL RIVER DIVERSION (SEGMENT MA34-32)

Location: Headwaters, outlet Paradise Pond, Northampton to the confluence with the Oxbow (east of Old Springfield Road), Northampton.
Segment Length: 2.6 miles.
Classification: Class B.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	79%
Residential	8%
Agriculture	7%

In Northampton, the Mill River enters Paradise Pond from which the river takes one of two paths. The interrupted/underground route (identified as the Mill River) appears on the eastern of the railroad tracks and crossing under Route 5 and Route 91, ultimately discharging into the Connecticut River mainstem at the northern edge of the Oxbow. This interrupted section of the Mill River is currently not discussed in this assessment report. The primary channel, the Mill River Diversion (MA34-32), flows generally south out of the Paradise Pond dam, crossing under Route 66 and Route 10 and flowing into Hulberts Pond. This pond then enters the western edge of the Oxbow.

As part of the "Invasive Plant Watch" program made possible by a grant from the Riverways Program and the local conservation districts, *Trapa natans* was identified and removed from ponds within the Mill River-Northampton, the Mill River, the mouth of the Oxbow, and the mouth of Dante's Pond (Boettner 2000).

USE ASSESSMENT

Current data/information was not available therefore all uses for Mill River Diversion (Segment MA34-32) are not assessed.

Mill River Diversion (Segment MA34-32) Use Summary Table

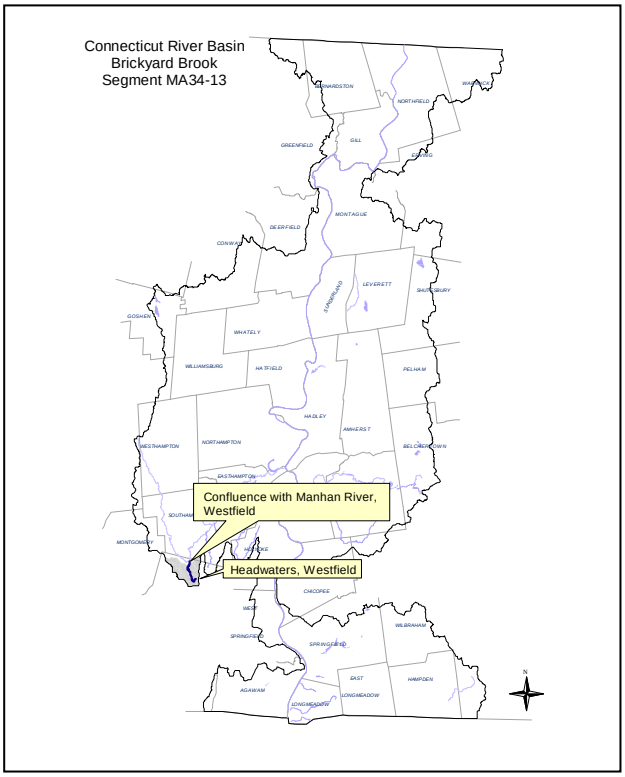
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

BRICKYARD BROOK (SEGMENT MA34-13)

Location: Headwaters, Westfield to confluence with Manhan River, Westfield.
Segment Length: 2.5 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	55%
Agriculture	30%
Residential	5%



USE ASSESSMENT

Current data/information was not available therefore all uses for Brickyard Brook (Segment MA34-13) are not assessed.

Brickyard Brook (Segment MA34-13) Use Summary Table

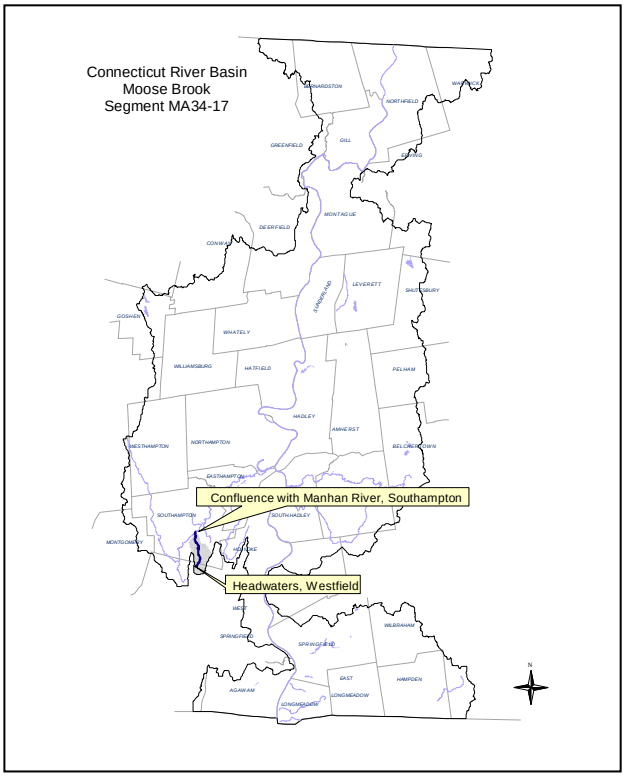
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

MOOSE BROOK (SEGMENT MA34-17)

Location: Headwaters, Westfield to confluence with Manhan River, Southampton.
Segment Length: 3.2 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	52%
Agriculture	26%
Residential	10%
Open Land	10%



USE ASSESSMENT

Current data/information was not available therefore all uses for Moose Brook (Segment MA34-17) are not assessed.

Moose Brook (Segment MA34-17) Use Summary Table

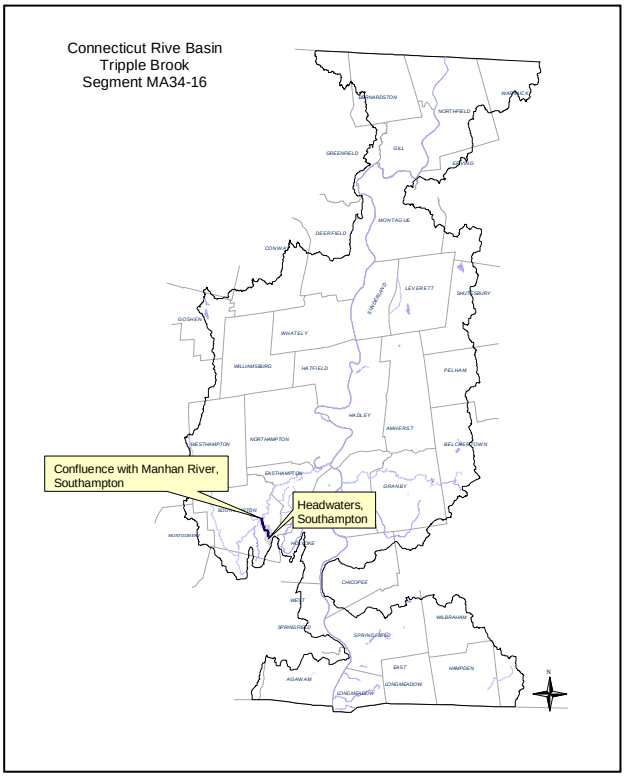
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

TRIPPLE BROOK (SEGMENT MA34-16)

Location: Headwaters, Southampton to confluence with Manhan River, Southampton.
Segment Length: 2.0 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	62%
Agriculture	28%
Residential	6%



USE ASSESSMENT

Current data/information was not available therefore all uses for Tripple Brook (Segment MA34-16) are not assessed.

Tripple Brook (Segment MA34-16) Use Summary Table

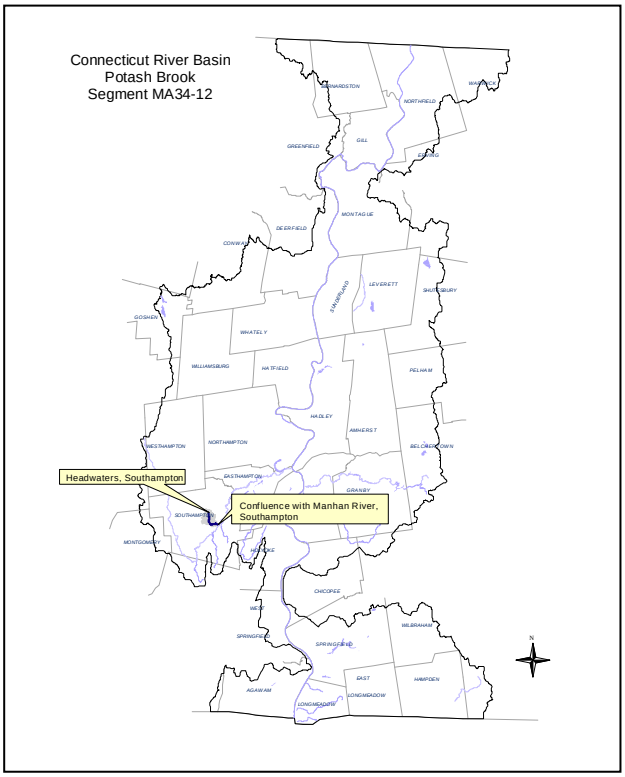
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

POTASH BROOK (SEGMENT MA34-12)

Location: Headwaters, Southampton to confluence with Manhan River, Southampton.
Segment Length: 1.50 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	62%
Agriculture	21%
Residential	11%



USE ASSESSMENT

Current data/information was not available therefore all uses for Potash Brook (Segment MA34-12) are not assessed.

Potash Brook (Segment MA34-12) Use Summary Table

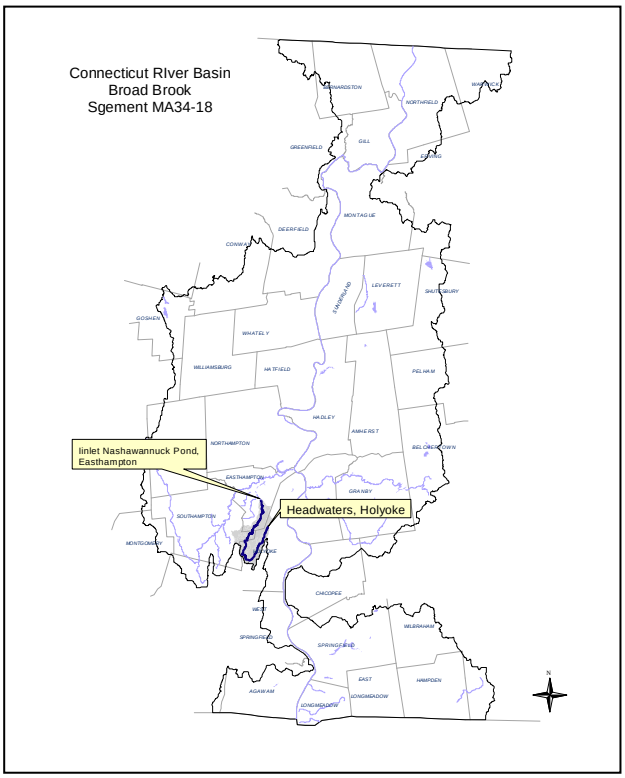
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

BROAD BROOK (SEGMENT MA34-18)

Location: Headwaters, Holyoke to inlet Nashawannuck Pond, Easthampton.
Segment Length: 10.9 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	67%
Residential	15%
Agriculture	12%



USE ASSESSMENT

Current data/information was not available therefore all uses for Broad Brook (Segment MA34-18) are not assessed. It should be noted however that a 319 Projects (98-05/319) *Nashawannuck Pond Watershed Restoration Project* began to implement recommendations identified in the 1990 Diagnostic/Feasibility study to improve water quality in the pond. A second project (01-09/319) *Nashawannuck Pond Restoration Phase II,* will design and install stormwater BMPs on Broad Brook and the eastern shoreline of the pond to reduce sediment and nutrient loads to the pond (Appendix A).

Broad Brook (Segment MA34-18) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

RECOMMENDATIONS

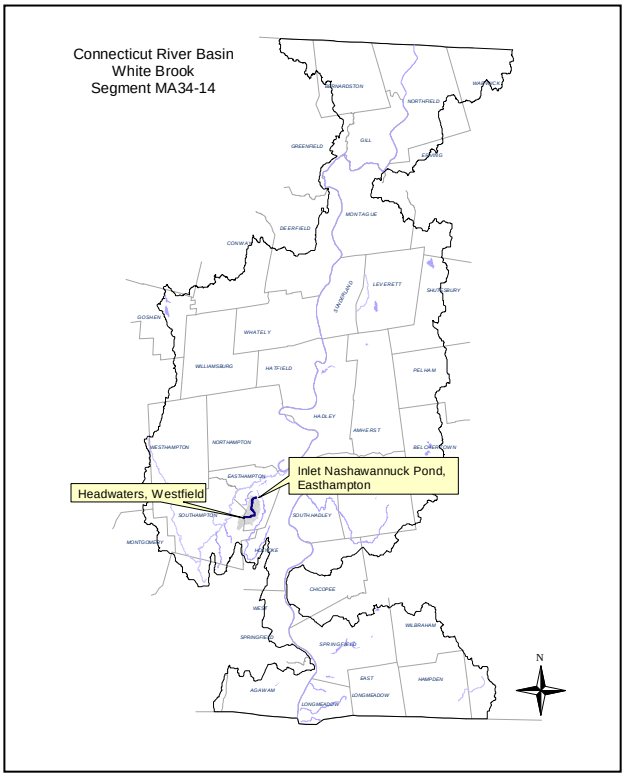
- Evaluate the effectiveness of the BMPs implemented in the Nashawannuck Pond Watershed Restoration Projects (Appendix A).

WHITE BROOK (SEGMENT MA34-14)

Location: Headwaters, Westfield to inlet Nashawannuck Pond, Easthampton.
Segment Length: 1.90 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	34%
Agriculture	32%
Residential	26%



USE ASSESSMENT

Current data/information was not available therefore all uses for White Brook (Segment MA34-14) are not assessed. It should be noted however that a 319 Project (98-05/319) Nashawannuck Pond Watershed Restoration Project has recently been conducted to implement recommendations of a 1990 Diagnostic/Feasibility study to improve water quality in the pond (Appendix A).

White Brook (Segment MA34-14) Use Summary Table

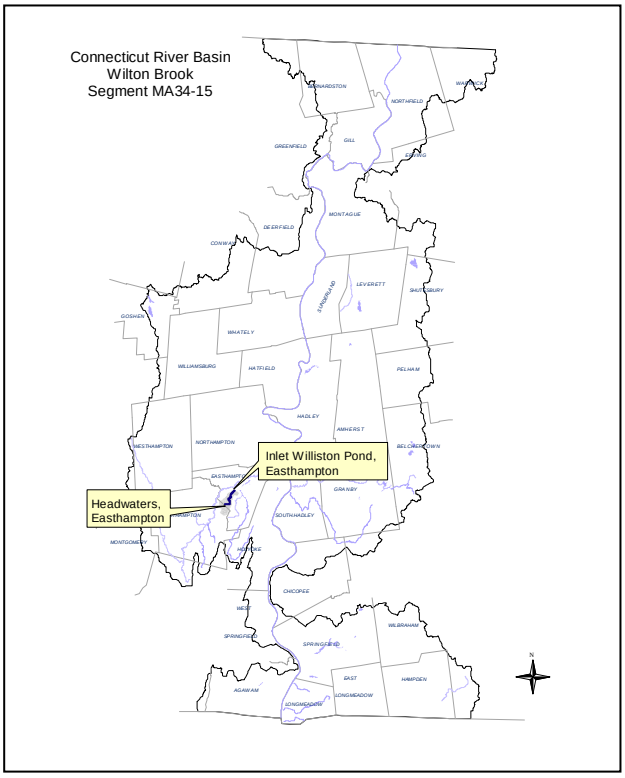
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

RECOMMENDATIONS

- Evaluate the effectiveness of the BMPs implemented in the Nashawannuck Pond Watershed Restoration Project (Appendix A).

WILTON BROOK (SEGMENT MA34-15)

Location: Headwaters, Easthampton to inlet Williston Pond, Easthampton.
Segment Length: 1.60 miles.
Classification: Class B, Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	45%
Residential	30%
Agriculture	14%

NPDES WASTEWATER DISCHARGE SUMMARY:

MA0001503 – J.P. Elastomerics Corporation (formerly J.P. Stevens and Company, Inc.) Easthampton produces thermo-plastic polyurethane tubing and discharges contact and non-contact cooling water via one outfall (001). The facility is permitted to discharge 114,000 GPD to a wetland adjacent to Wilton Brook. The effluent pH ranged from 6.5 to 8.5 SU. In 1999 there were six documented flow exceedances and three documented 3 pH exceedances (McCollum2000). The permit expired in September 1991.

USE ASSESSMENT

Current data/information was not available therefore all uses for Wilton Brook (Segment MA34-15) are not assessed.

Wilton Brook (Segment MA34-15) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

RECOMMENDATIONS

- MA0001503 – J.P. Elastomerics Corporation Easthampton permit should be reissued with appropriate monitoring requirements and limits (including toxicity testing).

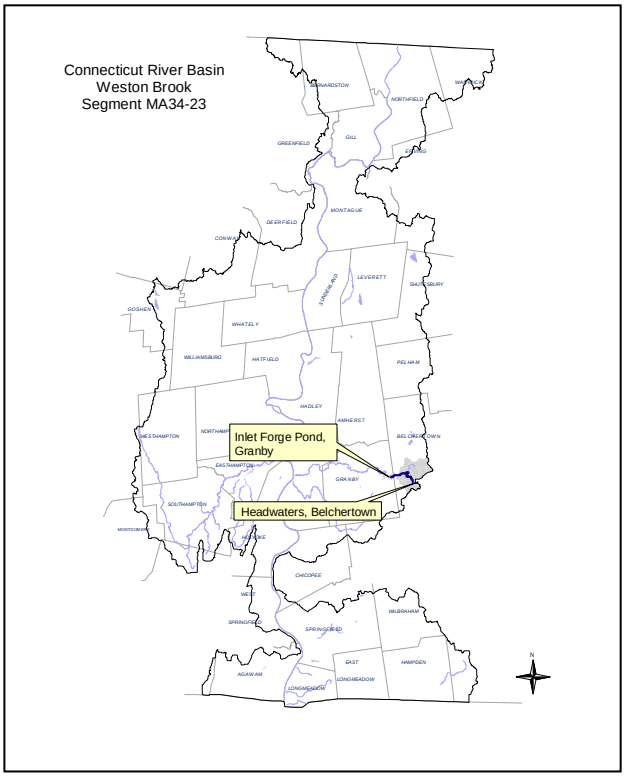
WESTON BROOK (SEGMENT MA34-23)

Location: Headwaters, Belchertown, to inlet Forge Pond, Granby.
Segment Length: 2.65 miles.
Classification: Class B.

As part of the "Invasive Plant Watch" program made possible by a grant from the Riverways Program and the local Conservation Districts, *T. natans* was identified and removed from Granby Pond (Boettner 2000).

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	64%
Agriculture	13%
Residential	11%



USE ASSESSMENT

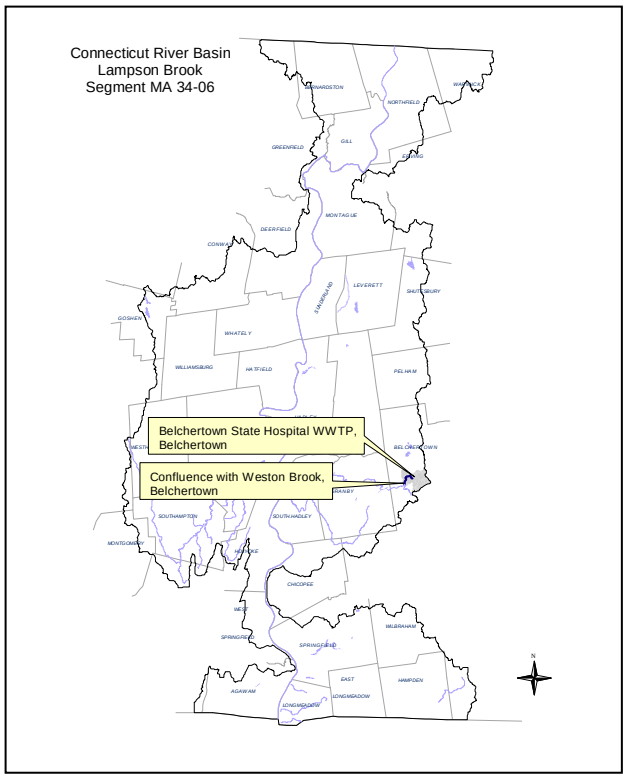
Current data/information was not available therefore all uses for Weston Brook (Segment MA34-23) are not assessed.

Weston Brook (Segment MA34-23) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

LAMPSON BROOK (SEGMENT MA34-06)

Location: Belchertown WWTP, Belchertown to confluence with Weston Brook, Belchertown.
Segment Length: 0.90 miles.
Classification: Class B Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	53%
Agriculture	17%
Open Land	14%

NPDES WASTEWATER DISCHARGE SUMMARY:

MA00102148 – Belchertown WWTP (permit transferred from the Belchertown State School in September 1994) is a secondary treatment plant, although it's current permit has tertiary treatment limits. The facility is authorized to discharge 1.0 MGD (Appendix C, Table C1). The facility is currently under an EPA Order requiring compliance with its NPDES permit by 17 August 2000. A new Sequencing Batch Reactor (SBR) with filtration, followed by UV disinfection, is presently under construction. The upgrade also includes chemical addition for phosphorus removal (Total Phosphorus limit of 0.25 mg/l in permit). Included within the EPA Order are interim limits, which the facility is presently meeting. The new treatment facility is the first SBR within the Western Region. The Belchertown WWTP average daily flow for 1999 was 0.285 MGD (McCollum 2000). The permit limits for whole effluent toxicity are $LC_{50} \geq 100\%$ and CNOEC $\underline{\geq}$ 90% effluent. Effluent ammonia-nitrogen concentrations reported in the Belchertown WWTP toxicity reports ranged between 1.20 mg/L and 17.0 mg/L, and TRC was only detected once in 17 samples (0.36 mg/L May 1997, all other results were <0.02 mg/L). The permit expired midnight 11 August 2000.

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Ambient

Belchertown WWTP collects Lampson Brook water upstream from this segment (currently not assessed) approximately 100 yards upstream of their discharge culvert at George Hannum Street.

Effluent

Belchertown WWTP conducted 17 effluent toxicity tests on *C. dubia* between February 1996 and February 2000 and six tests using *P. Promelas* from February 1996 to May 1997. The LC_{50}'s were $\underline{\geq}$ 100% effluent for both species. Chronic toxicity was <90% in only 1 of 17 samples (12.5% August 1997).

No recent instream sampling has been conducted and no current data/information was available, therefore all uses for Lampson Brook (Segment MA34-06) are currently not assessed.

Lampson Brook (Segment MA34-06) Use Summary Table

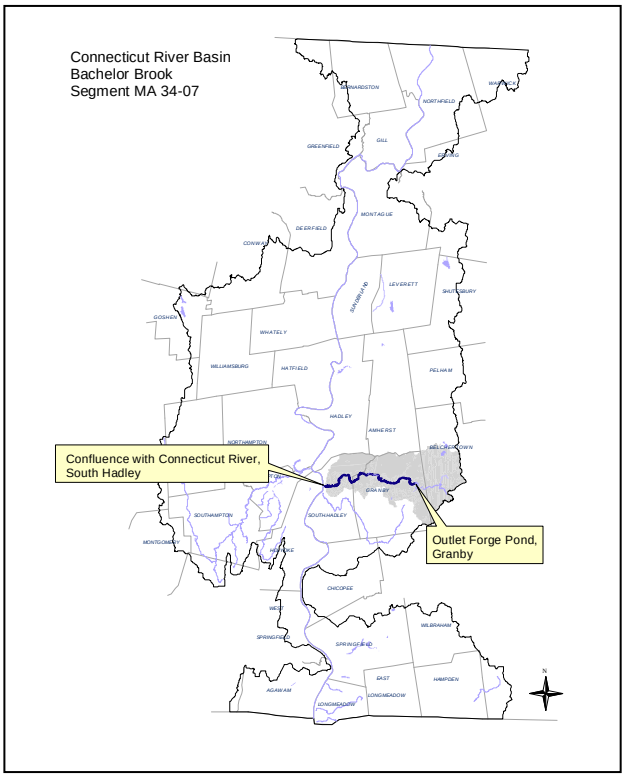
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

- Conduct an instream impact evaluation to determine if water quality in Lampson Brook is improving as the result of the recently upgraded Belchertown WWTP discharge. Whether or not the new facility (the first SBR facility within the MA DEP Western Regional Office) can meet its stringent limits will need to be closely monitored.

BACHELOR BROOK (SEGMENT MA34-07)

Location: Outlet Forge Pond, Granby to confluence with Connecticut River, South Hadley.
Segment Length: 9.1 miles.
Classification: Class B, Warm Water Fishery.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	71%
Residential	11%
Agriculture	9%

Silvio Conte National Fish and Wildlife Refuge, under a grant from the National Fish and Wildlife Foundation has provided coordination for many *T. natans*, a non-native invasive aquatic plant, hand-pulling events. Since early detection is key to control, EOEA, through the Franklin, Hampden, and Hampshire Conservation Districts, have hired an intern who is recruiting volunteers to actively check water bodies for the presence of water chestnut within the Connecticut River Watershed. This "Invasive Plant Watch" program was made possible by a grant from the Riverways Program and the local Conservation Districts (Boettner 2000). In 2000, a few *T. natans* were identified and removed from the mouth of Bachelor Brook and Granby Pond as part of the 2000 Connecticut River Watershed Water Chestnut Control Activities by the "Invasive Plant Watch" coordinator.

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
DEM Notch Visitors Center, Amherst	1008006-01G				0.0005 MGD
Tavern 21, Belchertown	1024010-01G				0.0019 MGD
St. Hyacinth College, Granby	1111001-01G 1111001-02G				0.010 MGD (01G) 0.0005 MGD (02G)
Granby Heights Condominiums, Granby	1111003-01G 1111003-02G				0.009 MGD
Granby Jr/Sr High, Granby	1111006-01G 1111006-02G				0
Granby Café Inc., Granby	1111008-01G				0.002 MGD
Cindy's Drive Inn, Granby	1111020-01G				0.001 MGD
South Hadley FD #2, South Hadley	1275001-01S 1275001-03G		1-06-275-02		0 (Both sources recently inactivated)
Total Withdrawals					*0.025 MGD*

USE ASSESSMENT

Current data/information was not available therefore all uses for Bachelor Brook (Segment MA34-07) are not assessed.

Bachelor Brook (Segment MA34-07) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

- Continue *T. natans* control programs.

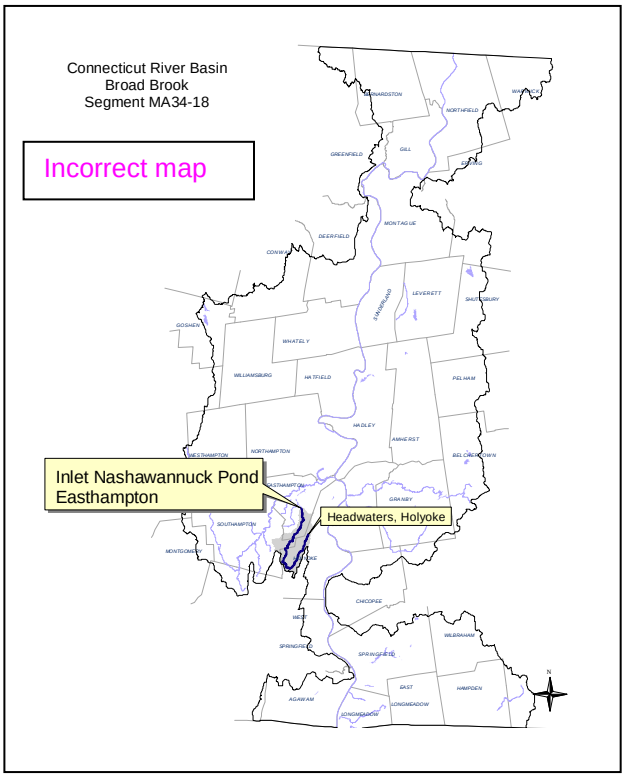
STONY BROOK (SEGMENT MA34-19)

Location: Headwaters, Granby to confluence with Connecticut River, South Hadley.
Segment Length: 13.6 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	43%
Agriculture	18%
Residential	17%

As part of the "Invasive Plant Watch" program made possible by a grant from the Riverways Program and the local conservation districts, *T. natans* was identified and removed from the Mt. Holyoke Ponds (O'Leary 2000).



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Westover ARB, Chicopee	1061003-01G				0 Emergency
Granby Housing Authority, Granby	1111002-01G				0.0035 MGD
Town of Granby, Granby	1111007-01G				0.0005 MGD
Stony Brook Lodge, Granby	1111013-01G				0.003 MGD
West Street School, Granby	1111014-01G				0.001 MGD
Granby Motel, Granby	1111015-01G				0.0015 MGD
Inter All Corp, Granby	1111017-01G				0
Granby Public Library, Granby	1111021-01G				0.00015 MGD
Aldrich Hall, Granby	1111022-01G				0.0004 MGD
Crescent Valley Condos, Granby	1111025-01G 1111025-02G				0.003 MGD
Halon Plaza, Granby	1111027-01G				0.0008 MGD
American Legion Post #266, Granby	1111028-01G				0.003 MGD
Pizza Palace, Granby	1111029-01G				0.003 MGD
Bakery Box, Granby	1111031-01G				0.001 MGD
Chateau Harmony, Granby	1111032-01G				0.0022 MGD
Cumberland Farms, Inc., Granby	1111033-01G				0.0002 MGD
Getty Mart, Granby	1111034-01G				0.0003 MGD
Total Withdrawals					*0.024 MGD*

USE ASSESSMENT

Current data/information was not available therefore all uses for Stony Brook (Segment MA34-19) are not assessed.

Stony Brook (Segment MA34-19) Use Summary Table

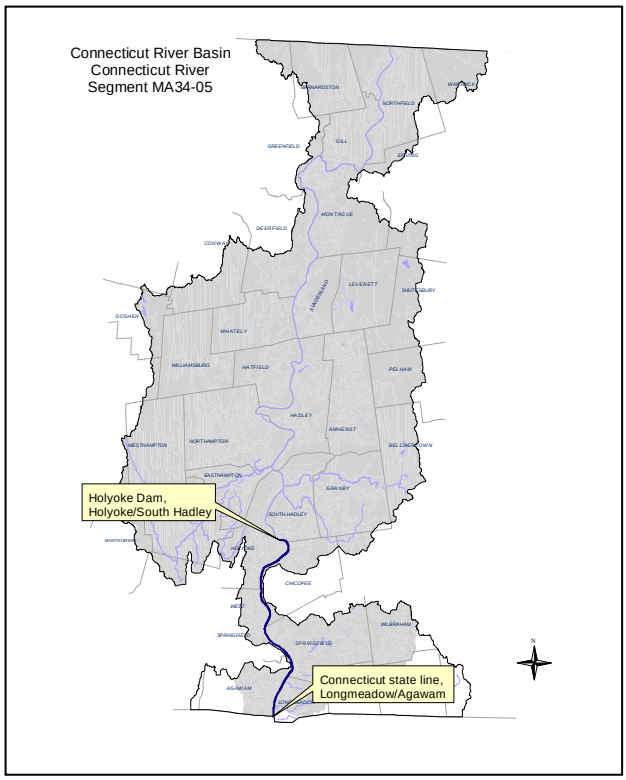
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

- Continue *T. natans* control programs.

CONNECTICUT RIVER (SEGMENT MA34-05)

Location: Holyoke Dam, Holyoke/South Hadley to Connecticut state line, Longmeadow/Agawam.
Segment Length: 15.9 miles.
Classification: Class B, Warm Water Fishery, CSO.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	61%
Residential	14%
Agriculture	13%

At the upper end of this segment, some flow from the Connecticut River is diverted into the Holyoke Hydroelectric Project three level canal system. This canal system is utilized to generate power (described in the FERC summary), and receives wastewater from several permittees (described in the NPDES wastewater discharge summary). Water quality conditions in the canal system itself are not assessed in this report.

Three reaches were used to organize water withdrawal and NPDES permitting information within this segment of the Connecticut River:

- Reach 05A: Connecticut River from Holyoke Dam, Holyoke/South Hadley to confluence with Chicopee River.
- Reach 05B: Connecticut River from confluence with Chicopee River to confluence with Westfield River, West Springfield.
- Reach 05C: Connecticut River from confluence with Westfield River, West Springfield to State line.

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Reach 05A: Connecticut River from Holyoke Dam, Holyoke/South Hadley downstream to confluence with Chicopee River					
Holyoke Water Works, Holyoke	1137000-02S		1-06-137-11	8.040 MGD	0 (emergency only)
Hazen Paper Company, Holyoke			1-06-137-01	0.130 MGD	0.36 MGD
Parsons Paper Company, Div. NVF, Holyoke			1-06-137-03	0.590 MGD	0.29 MGD
Wykoff Country Club, Holyoke			1-06-137-05	0.040 MGD	0.029 MGD
Sonoco Products Co., Holyoke			1-06-137-06	0.850 MGD	0.61 MGD
Holyoke Gas & Eectric Company, Holyoke			1-06-137-08	0.611 MGD	0.173 MGD
Linweave Inc/Harris Energy & Reality, Holyoke			1-06-137-09	0.716 MGD	Not is use 1999
Mt Tom Ski Area, Holyoke			1-06-137-10	1.130 MGD	Shut down
Kodak Polychrome Graphics – ANITEC, Holyoke		9P-1-06-131.01		0.47 MGD	0.25 MGD
Rexham Graphics, South Hadley			1-06-275-01	0.200 MGD	0
South Hadley Golf Course, South Hadley		9P2-1-06-275.02			Not yet constructed
Reach-05B: Connecticut River from confluence with Chicopee River to confluence with Westfield River, West Springfield. None Known					
MA34-05C Connecticut River from confluence with Westfield River at West Springfield downstream to State line.					
Longmeadow Water Department, Longmeadow	1159000-01G 1159000-02G				N/A Consecutive system, source is PWS #1281000

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Pioneer Valley Yacht Club, Longmeadow	1159001-01G				TNC* no meter
Field Club of Longmeadow, Longmeadow	1159002-01G				TNC
Tuckahoe Turf Farm, Agawam			1-06-005-01	0.070 MGD	0.112 MGD
Crestview Country Club, Agawam			1-06-005-02	0.060 MGD	0.068 MGD
Agawam Country Club		9P2-1-06-005.01			Withdrawn
Twin Hills Country Club, Longmeadow			1-06-159-01	0.100 MGD	0.097 MGD
Longmeadow Country Club, Longmeadow			1-06-159-02	0.100 MGD	0.102 MGD
Total Withdrawals, MA34-05				*13.107 MGD*	*1.767 MGD*

* TNC = Transient non-community

NPDES WASTEWATER DISCHARGE SUMMARY:

Reach 05A - Connecticut River from Holyoke Dam, Holyoke/South Hadley to confluence with Chicopee River.

MA0001520 Holyoke Gas & Electric Department, Cabot Street Station, Holyoke, a steam and electric power company, has reapplied (April 2000) to discharge via two outfalls:

Outfall #001 – 10.8 MGD of condenser cooling water to the first level of the Holyoke Canal (30º rise in temperature)

Outfall #002 – 0.025 MGD of neutralization of spent demineralizer reagent wastewater to the second level of the Holyoke Canal.

Holyoke Water Power Company power plant cooling water discharges :

NPDES Permit #	Facility Name	Receiving Waters	Kilowatts
MA0035874	Boatlock Station	First Canal to Second Canal	2,900
MA0035564	Riverside Station	Second Canal to Connecticut River	7,640
MA0035866	Chemical Station	Third Canal to Connecticut River	1,600
MA0035882	Hadley Falls Station	Holyoke Canal	308,000
Unpermitted waterwheel	Skinner Station	First Canal to Second Canal	300
Unpermitted waterwheel	Beebe-Holbrook	First Canal to Second Canal	516

FEDERAL ENERGY REGULATORY COMMISSION (FERC):

Project Name	Owner	Project #	Issue Date	Expiration Date	River	Kilowatts
Hadley Falls	Holyoke Water Power Company	2004	20 August 1999	31 August 2039	Connecticut River	45,675
Holyoke No. 1	City of Holyoke (HG&E)	2386	28 February 1989	31 January 2019	Holyoke Canal	1,065
Holyoke No. 2	City of Holyoke (HG&E)	2387	28 September 1988	31 August 2018	Holyoke Canal	800
Holyoke No. 3	City of Holyoke (HG&E)	2388	28 September 1988	31 May 2020	Holyoke Canal	450
Holyoke No. 4	City of Holyoke (HG&E)	7758	19 March 1987	28 February 2007	Holyoke Canal System	760
Holyoke No. 5	Holyoke Economic Dev & Indl Corp. (HG&E)	10806	29 June 1990	31 May 2030	Connecticut River	790

Project Name	Owner	Project #	Issue Date	Expiration Date	River	Kilowatts
Mt Tom Mill	Harris Energy & Realty Corp.	2497	29 June 1989	28 February 2012	Holyoke Canal	500
Crocker Mill A/B	Harris Energy & Realty Corp.	2758	29 June 1989	28 February 2012	Holyoke Canal	350
Albion Mill (D Wheel)	Harris Energy & Realty Corp.	2766	29 June 1989	28 February 2012	Holyoke Canal	500
Albion Mill (A Wheel)	Harris Energy & Realty Corp.	2768	29 June 1989	28 February 2012	Holyoke Canal	312
Crocker Mill (C Wheel)	Harris Energy & Realty Corp.	2770	29 June 1989	28 February 2012	Holyoke Canal	300
Linweave Warehouse (A Wheel)	Harris Energy & Realty Corp.	2772	29 June 1989	28 February 2012	Holyoke Canal	450
Linweave Warehouse (D Wheel)	Harris Energy & Realty Corp.	2775	29 June 1989	28 February 2012	Holyoke Canal	450
Nonotuck Mill	Linweave Inc.	2771	29 June 1989	28 February 2012	Holyoke Canal	500

The Holyoke Dam Hydroelectric Project is an operating licensed facility located on the Connecticut River in the city of Holyoke and the town of South Hadley. The project's principle features consist of a single dam structure, a three level canal system, an impoundment, upstream and downstream fish passage facilities, six power houses and appurtenant facilities (MA DEP 1999b). This project is operated in an instantaneous run-of-river mode. The flow distribution regimes are currently being developed. As of August 1999 included the following:

1. flows sufficient to operate fish passage facilities
2. zone of passage flows (1300 cfs),
3. canal minimum flows (810 cfs),
4. Hadley Falls Station to Unit One capacity (4,200 cfs),
5. Canal operations to canal capacity,
6. Hadley Falls Station to capacity

MA0100455 – South Hadley WWTP is a conventional secondary treatment plant which is authorized to discharge 4.2 MGD to the Connecticut River (Appendix C, Table C1). The facility served a combined sewer system, which is presently being separated. Upon completion of the sewer separation, additional capacity will be available at the facility. The facility is also required to develop and implement an industrial pretreatment program. The permit limits for whole effluent toxicity are $LC_{50} \geq 50\%$ effluent. The average daily flow was 2.88 MGD in 1999 and the plant has met its permit limits within the last three years (McCollum 2000). The current permit expired midnight 10 October 2000.

MA0101630 – The Holyoke WWTP is a conventional secondary treatment plant which is authorized to discharge 17.5 MGD to the Connecticut River (Appendix C, Table C1). The facility serves a combined sewer system in the City of Holyoke and is in the process of developing a long term combined sewer overflow control plan. The facility is also required to develop and implement an industrial pretreatment program. In 1999, the Holyoke WWTP average daily flow was 9.0 MGD. The facility has met its permit limits within the last three years (McCollum 2000). The permit limits for whole effluent toxicity are $LC_{50} \geq$ 100% effluent. The current permit expired midnight 29 September 2000. (See Table 7 for a summary of their toxicity testing report data.)

The Holyoke combined sewage collection system has 15 active permitted CSO outfalls that discharge an estimated 517 million gallons per year (MGY)of untreated combined sewage into the Connecticut River (Tighe & Bond 2000a). Eight of these CSOs discharge an estimated 383 MGY to this segment of the Connecticut River including the largest CSO discharge (CSO #009, which discharges an estimated 292 MGY). The following eight CSOs discharge into the upper five-mile reach of this segment of the Connecticut River:

CSO 002 Providence Hospital (Connecticut River)
CSO 003 Jones Ferry Road (Connecticut River)
CSO 008 Springdale Park (Connecticut River)
CSO 009* Berkshire Street at the Berkshire Street Arch (Connecticut River)

CSO 011 Jackson Street (Connecticut River)
CSO 013 Appleton Street (Connecticut River)
CSO 014 Mosher Street (Connecticut River)
CSO 016 Front and Appleton Street (1st level canal)
Two CSOs are now inactive:
CSO 015 Front and Cabot Street (1st level canal)
CSO 017 Front and Lyman Street (1st level canal)

MA0101508 – Chicopee combined sewage collection system has a total of 31active permitted CSO outfalls, fourteen of which discharge to this segment of the Connecticut River (Tighe & Bond 2000b) as described below. An estimated 450 MGY of CSO is discharged from these 14 CSO outfalls (Metcalf and Eddy 1988), The three largest CSOs* in this segment discharge approximately 274 MG/yr.

CSO 001* Britton Street (44 MGY.)
CSO 003* Power Line right-of-way south of James Street (36 MGY.)
CSO 004 Riverview Place Sewage Pumping Station
CSO 005 Leslie Street Sewage Pumping Station
CSO 006 Call Street Sewage Pumping Station
CSO 007* I and II Jones Ferry Road Sewage Pumping Station (194 MGY.)
CSO 008 Easment south of Jones Ferry Road Sewage Pumping Station
CSO 009 Paderewski Street Sewage Pumping Station
CSO's 024 I through V Emerald and West Street area
[NOTE: The facility also has 17 active permitted CSOs that discharge approximately 200 MGY into the Chicopee River.]

Reach 05B- Connecticut River from confluence with Chicopee River to confluence with Westfield River.

MA0101508 – Chicopee WWTP is a conventional secondary treatment plant which is authorized to discharge 15.5 MGD to the Connecticut River (Appendix C, Table C1). The facility serves a combined sewer system and with the City of Chicopee is in the process of developing a combined sewer overflow long term control plan. The combined sewer system, with the resulting high flow during rain events, has resulted in the facility having difficulty meeting its maximum daily limits although their average daily ~~for~~ discharge in 1999 was 9.33 MGD (McCollum 2000). The facility is also required to develop and implement an industrial pretreatment program. The permit limits for whole effluent toxicity are $LC_{50} \geq$ 100% effluent. Due to whole effluent toxicity problems, the facility undertook a toxicity identification evaluation (TIE) between May 1997 and May 1998 which tentatively identified surfactants as the suspect toxicants (Hamel 1998). The facility is currently adding a bacterial additive to eliminate the problem. Since August 1998, the whole effluent toxicity test results has greatly improved with only one toxic event in six tests. The current permit expired midnight 29 October 2000.

MA0101613 – The Springfield Regional WWTP is a conventional secondary treatment plant that is authorized to discharge 67 MGD to the Connecticut River (Appendix C, Table C1). The aeration system for the facility was recently upgraded from mechanical aeration to fine bubble diffused aeration. In 1999 the average daily flow was 33.88 MGD. The facility serves several communities including Springfield, Agawam, West Springfield, Longmeadow, East Longmeadow, Ludlow and Wilbraham. Several of the communities have combined sewer systems. During wet weather the facility has the capability of bypassing primary and/or secondary treatment. The facility is under an EPA Order to develop a combined sewer overflow long term control plan (McCollum 2000). The facility is also required to develop and implement an industrial pretreatment program. The permit limits for whole effluent toxicity are $LC_{50} \geq$ 100% effluent. The permit expired midnight 29 September 2000.

MA0103331 – The Springfield combined sewage collection system is permitted to discharge through 25 CSOs to the Connecticut, Chicopee and Mill rivers. This facility has seven CSOs that discharge approximately 9MGY into the Mill River and six CSOs that discharge approximately 23 MGY into the Chicopee River. Twelve CSOs discharge approximately 548 MGY of untreated combined sewage to this segment of the Connecticut River (Metcalf and Eddy 2000). Of this 548 MGY total, the three largest CSOs (007*, 010* and 012*) discharge a cumulative 340 MGY.

CSO 007* Rowland Street (103 MGY)
CSO 008 Washburn Street

CSO 010* Clinton Street (110 MGY)
CSO 011 Liberty Street
CSO 012* Worthington Street (127 MGY)
CSO 013 Bridge Street.
CSO 014 Elm Street (Elin Street) also referred to as Liberty Street
CSO 015 Union Street
CSO 016 York Street
CSO 018 Longhill Street
CSO 043 Banner Street
CSO 049 Springfield Street

MA0101389 –The Town of West Springfield Department of Public Works permit for CSO 009 (New Bridge and Bridge Streets) to this segment of the Connecticut River has been eliminated.

MA0101320 –The Town of Agawam Department of Public Works permit including CSO 012 (Leonard Street at River Street) to this segment of the Connecticut River has been eliminated.

MA0004707– ConEd Energy, MA, Inc. West Springfield Station (formerly Western Massachusetts Electric Company) is a power station that generates electricity by the combustion of oil and gas. The facility's permit expired in September 1993 and has been administratively continued (expired permit remains in effect until a new permit is issued). The facility withdraws water from the Connecticut River near the Agawam/West Springfield town line and discharges via four outfalls to the Connecticut River as follows:

001 A & B cooling water (70 MGD when active and discharges approximately 1 mile downstream of intake)
002 A & B cooling water (021 settling pond discharge via 002 A & B) (70.3 MGD and discharges approximately 2.5 miles downstream of intake)
006 turbine haul roof drains and front yard storm drains
005 intake screens and sluice water (1.6 MGD)

MAG250951– Danaher Tool, Springfield discharges 0.015 MGD of non-contact cooling water to the Connecticut River. The permit was issued in August 1995.

MA00293279 – Agri-mark, West Springfield permit expired in March 1991 and has been administratively continued (expired permit remains in effect until a new permit is issued).

Reach 05C - Connecticut River from confluence with Westfield River, West Springfield to State line.
None Identified

USE ASSESSMENT

AQUATIC LIFE

Biology
Sediment in the Connecticut River in the vicinity of Holyoke Gas Works (below the Holyoke Dam) are known to be contaminated with coal tar (Kocan 1993). Coal tar contains high concentrations of polynuclear aromatic hydrocarbons (PAH), many of which are known to cause reproductive and teratogencic effects in a range of fish species. This area of the river is spawning habitat for the shortnose sturgeon, a federally listed ~~endarged~~ endangered species. The former Holyoke Gas Works facility is a Tier 1A hazardous waste site that is currently in Phase IV (implementing Selected Remedial Action Alternatives and Remedies) (MA DEP 7 November 2000~~e~~).

Toxicity

Ambient and effluent toxicity data were summarized (Table 7) for four NPDES permitted facilities which submitted whole effluent toxicity reports to MA DEP DWM that discharge to this segment of the Connecticut River. These facilities submitted a total of 60 acute whole effluent toxicity testing results on tests which were conducted between February 1996 and May 2000. Holyoke WPCF (collects dilution water from the upstream segment of the Connecticut River, MA34-04) and discharges to this segment of the Connecticut River MA34-05, therefore the ambient dataset includes 42 data points.

Ambient

Survival of test organisms *C. dubia* and *P. promelas* exposed (48-hour) to Connecticut River water was ≥ 95%.

Effluent

Ninety eight percent of the whole effluent toxicity tests submitted by South Hadley WWTP, Holyoke WPCF, and Springfield WWTP were >100% effluent. South Hadley's WWTP's effluent was acutely toxic to C*. dubia* in one event in May 1997. Chicopee WWTP's effluent, however, was acutely toxic on a regularly basis to *P. promelas* (60% of the test events).

Table 7. Summary of TOXTD data: Connecticut River Segment MA34-05.

AMBIENT	River Flow	EFFLUENT
SOUTH HADLEY WWTP – East side of river downstream of Route 116 Bridge, ~ 0.5 miles upstream from outfall below Holyoke Dam **Data set:** 8 tests May 1996 - August 1999 **Survival:** *C. dubia* 100% 48 hours **Suspended Solids:** < 2.5 – 6.5 mg/L **TRC:** 0.01 – 0.05 mg/L **pH:** 6.4 - 7.9 SU **Ammonia-nitrogen:** 0.05 – 4.2 mg/L **Hardness:** 24 – 42 mg/L		**SOUTH HADLEY WWTP –** Outfall 001 **Data set:** 8 tests May 1996 - August 1999 **LC_{50}:** *C. dubia* 48%- > 100% effluent (1acutely toxic event in May 1997) **TRC:** ≤0.02 – 0.05 mg/L **Ammonia-nitrogen:** 1.6 – 21.5 mg/L
HOLYOKE WPCF - in segment MA34-04		**HOLYOKE WPCF** – Outfall 001A **Data set:** 18 tests February 1996 - May 2000 **LC_{50}:** *C. dubia* ≥ 100% effluent. **TRC:** ≤0.02 – 0.1 mg/L **Ammonia-nitrogen:** 2.17 - 14 mg/L
CHICOPEE WWTP – 50-100 yards upstream of discharge near boat ramp, just south of Route 90 **Data set: 20** tests February 1996 - May 2000 **Survival:** *P. promelas* ≥95% 48 hours **Suspended Solids:** < 5.0 – 47.0 mg/L (1 of 18 >25 mg/L) **TRC:** <0.02 – 0.07 mg/L (only 1 exceeded 0 05) **pH:** 6.6 – 8.0 SU **Ammonia-nitrogen:** 0.03 - 0.34 mg/L **Hardness:** 23 – 48 mg/L		**CHICOPEE WWTP** – Outfall 010 **Data set:** 20 tests February 1996 - May 2000 **LC_{50}:** *P. promelas* <6.25% - ≥ 100% effluent (12 acutely toxic events) **TRC:** ≤0.02 – 4.7 mg/L **Ammonia-nitrogen:** 4.9 - 17 mg/L
SPRINGFIELD WWTP – upstream North End Bridge **Data set: 1**4 tests May 1997 - August 1998 *P. promelas* May 1997- May 2000 **Survival:** *C. dubia* 100% 48 hours **Suspended Solids:** <1.0 - 16 mg/L **TRC:** not detected **pH:** 6.6 - 7.9 SU **Ammonia-nitrogen:<0.03 - 0.4** mg/L **Hardness:** 25 – 64 mg/L		**SPRINGFIELD WWTP –** Outfall 041 **Data set: 1**4 tests May 1997 - August 1998 *P. promelas* May 1997- May 2000 **LC50:** *C. dubia* ≥ 100% effluent **TRC:** ≤0.02– 0.1 mg/L **Ammonia-nitrogen:** <0.2 - 11 mg/L

Chemistry – sediment

USGS as part of their NAWQA study, analyzed sediment collected from the Connecticut River near Longmeadow. The concentration of total PCB was <50 PPM (Harris 1997). This sediment sample was comprised primarily of sand (92%) and silt (7%) while the total organic carbon (TOC) was 2.67%. Cadmium (0.7 PPM), chromium (98 PPM), copper (43 PPM), lead (41 PPM), manganese (950 PPM), nickel (42 PPM) and zinc (160 PPM) exceeded the L-EL guidelines (Persaud *et al*.1993). Iron (4.5%) exceeded the S-EL guideline.

*Note: The S-EL guideline for PCB varies depending on the total organic carbon content (TOC) in the sample. Results have been summarized above using a conservative TOC estimate of 1% (where the S-EL = 5.3 PPM) and the maximum guidance allowable TOC of 10% (where the S-EL = 53 PPM).

Chemistry – tissue

At the USGS NAQWA study site on the Connecticut River near Longmeadow the concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) was 1,400 μg/kg wet weight (Coles 1998). This level of PCB exceeded (2.8 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500μg/kg wet weight for the protection of fish-eating wildlife. Neither total DDT nor total chlordane exceeded the NAS/NAE guidelines. While this dataset however is limited to only one sample per station, the presence of PCB in fish throughout the entire mainstem Connecticut River (in MA), places the *Aquatic Life Use* on "Alert Status".

This segment of the Connecticut River is affected by multiple discharges (NPDES permittees, power plants, and CSOs), and hazardous waste site remediation activities (coal tar). Because of these threats to aquatic life, it is best professional judgement that the limited data (presented above) was insufficient to characterize the status of the *Aquatic Life Use* and therefore it is not assessed. PCB contamination has been identified as an issue of concern ("Alert Status") for this use.

FISH CONSUMPTION

MA DPH issued a fish consumption advisory for the Connecticut River (all towns between Northfield and Longmeadow), recommending that "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River and the general public should not consume channel catfish, white catfish, American eel, or yellow perch because of elevated levels of PCB (MA DPH 1999).

Data used to issue the fish consumption advisory for the Connecticut River (PCB contamination) are now approximately ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered. A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. Fish sampling for this project was initiated in 2000. This project is being managed by NEIWPCC and US EPA NERL. A summary of this project and its study objectives are presented in Appendix B.

Because of the MA DPH fish consumption advisory, the entire 15.9 miles of this segment do not support the *Fish Consumption Use*.

PRIMARY CONTACT RECREATIONAL USE

While communities are implementing CSO pollution abatement strategies, multiple CSOs currently discharge to this segment of the Connecticut River. The large volume and number of CSOs contributing pathogens in untreated combined sewage to this segment of the Connecticut River impairs the *Primary Contact Recreational Use* (McCollum 2000).

- Chicopee- fourteen CSOs cumulatively discharge an estimated 450 MGY of untreated combined sewage (the three largest CSOs discharging approximately 274 MGY) to this segment,
- Holyoke combined sewage collection system cumulatively discharges an estimated 383 MGY of untreated combined sewage via eight CSOs (largest discharges 291 MGY) to this segment,
- Springfield Regional combined sewage collection system cumulatively discharges an estimated 548 MGY of untreated combined sewage via 12 CSOs to this segment,
- Town of West Springfield Department of Public Works - one CSO to this segment

- Town of Agawam Department of Public Works - one CSO to this segment

The *Primary Contact Recreational Use* is assessed as non support for this segment of the Connecticut River based on these CSOs discharges.

SECONDARY CONTACT RECREATIONAL USE

Although CSO pollution abatement strategies are being implemented, multiple CSOs currently discharge to this segment of the Connecticut River (as described above). Because of these discharges, the *Secondary Contact Recreational Use* is assessed as partial support for this segment of the Connecticut River.

Connecticut River (Segment MA34-05) Use Summary Table

Designated Uses		Status	Causes	Sources
Aquatic Life*		NOT ASSESSED		
Fish Consumption		NON SUPPORT	PCB contamination	Unknown
Primary Contact		NON SUPPORT	Pathogens	CSOs, urban runoff/storm sewers, unknown
Secondary Contact		PARTIAL SUPPORT	Pathogens	CSOs, urban runoff/storm sewers, unknown
Aesthetics		NOT ASSESSED		

**** "Alert Status"*** issues identified – details in Chemistry-tissue

RECOMMENDATIONS

- Historically, elevated fecal coliform bacteria levels were documented in this segment of the Connecticut River. Monitoring of fecal coliform bacteria should be conducted under both wet and dry sampling conditions to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

- Review the results of the *Fish Tissue Testing in the Connecticut River* study developed by the Connecticut River Forum in 1999.

- Track progress of CSO abatement activities.
  - The three major CSO permittees, the Cities of Springfield, Chicopee, and Holyoke, are now in the process of CSO facilities planning. Springfield and Holyoke have submitted *Draft* Facilities Plan (DFP)/Environmental Impact Report (EIR) documents. Chicopee is still in the process of doing the work to support their DFP/EIR (Hogan 2000). There are outstanding technical and affordability issues with all three of the CSO communities. These issues shall be resolved through further planning work, through the MEPA process, and further regulatory meetings/negotiations. The final facility's plans, which are now expected to be filed in late 2001 or early 2002, have been delayed to allow the communities to collaborate on a receiving water quality modeling project. The receiving water model, which was developed for the Springfield plan, is being expanded to include the regional area from the Holyoke CSOs (upstream of the Holyoke Dam) south to the CT line. The modeling project, which includes some dry and wet weather instream sampling, CSO sampling, and stormdrain sampling, will allow for an improved understanding of the collective impacts of regional CSO abatement strategies.
  - In the CSO impact area, the Connecticut River is Class B. A CSO-impacted segment can only be reclassified to B (CSO) or B (partial) or C if the findings of the facility planning efforts identify levels of CSO control reflective of those classifications to be the highest feasible level of control. The final facilities plan also needs to support a Use Attainability Analysis in this regard as well (Brander 2000).

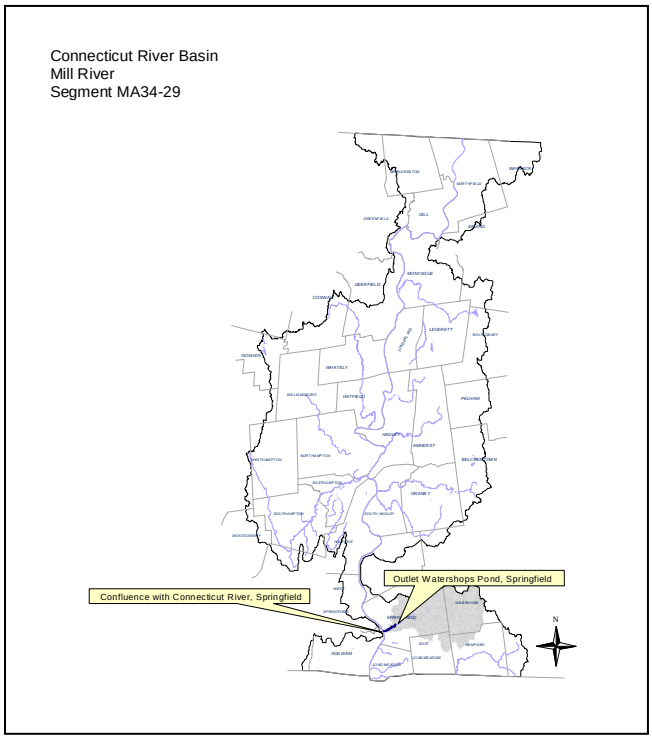
- Holyoke, Springfield, and Chicopee will be required to implement “9 Minimum Controls” as a condition of their new NPDES permits as well as to develop a long-range control plan to address abatement of impacts related to CSOs (Hogan 2000). Depending on the results of the Final CSO plan, the SWQS will need to be updated. If any CSO discharges are to remain, then a B (CSO) designation would be necessary (Brander 2000).

- Continue to evaluate the results of the Chicopee WWTP (MA0101508) toxicity tests to monitor the effectiveness of their toxicity reduction actions.

- MA0004707 ConEd Energy, MA, Inc. West Springfield Station (formerly Western Massachusetts Electric Company). The facility currently uses chlorine to control biofouling in the steam condenser tubes. Shortnose sturgeon, a federally endangered species, are reportedly attracted to thermal plumes and are also believed to be extremely sensitive to chlorine. The facility chlorinates for approximately 15 minutes every three hours. Sensitive life stages of the sturgeon may be utilizing the heated discharge plume as preferred habitat in the winter, and may be exposed to pulses of chlorine that may have a negative effect on them. Furthermore higher temperatures increase the metabolic rates of cold-blooded animals and would exacerbate the negative effects of chlorine. If sturgeon or other fish are preferentially using the thermal plume, dechlorination should be considered. Studies designed to 1) characterize the species utilizing the thermal plume as habitat throughout the year, 2) to evaluate entrainment and impingement effects and 3) to evaluate the thermal plume should also be considered (Szal 2000).

MILL RIVER-SPRINGFIELD (SEGMENT MA34-29)

Location: Outlet of Watershops Pond, Springfield to confluence with the Connecticut River, Springfield (interrupted stream).
Segment Length: 1.3 miles.
Classification: Class B.



Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Residential	42%
Forest	38%
Open land	9%

The largest contiguous inland stand of Atlantic White Cedar in Massachusetts is located in the headwater areas of this segment along the north branch of the Mill River in Wilbraham. This unique area contains vernal pools and a diverse mixture of bog and wetland plants. This area is also designated as estimated habitat for rare and endangered species by the Natural Heritage and Endangered Species Program of DEM (McCollum 2000).

In 2000, the City of Springfield and MA DEP initiated an effort to collectively develop a Comprehensive Watershed Management Plan for Watershops Pond (a.k.a. Lake Massasoit) watershed. Watershops Pond is on the 1998 303d list (impaired water). The lake routinely receives fecal coliform bacteria and other stormwater related pollutants and violates Class B Water Quality Standards. The lake and surrounding watershed will be evaluated and various pollutant discharges prioritized for remediation. The Mayor of Springfield has assembled a Task Force comprised of various City Departments, the Springfield Water & Sewer Commission, MA DEP, and a consultant to develop specific BMP recommendations for implementation in the watershed. The Task Force will use the data presented in the 1986 Diagnostic Feasibility Study prepared for the lake. The Task Force will look closely at remedial measures targeted to reduce and treat the heavy pollutant loading to the lake from stormwater (McCollum 2000).

WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Wilbraham Water Department, Wilbraham	1339000-01G	9P2-1-06-339.01		pending	0 (New Well)

NPDES WASTEWATER DISCHARGE SUMMARY:

MA0103331 – The Springfield Regional WWTP is permitted to discharge through 25 CSOs to the Connecticut, Chicopee and Mill rivers. This facility has seven CSOs that discharge approximately 9MGY into the Mill River-Springfield.

USE ASSESSMENT

Current data/information was not available therefore all uses for Mill River-Springfield (Segment MA34-29) are not assessed.

Mill River-Springfield (Segment MA34-29) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS

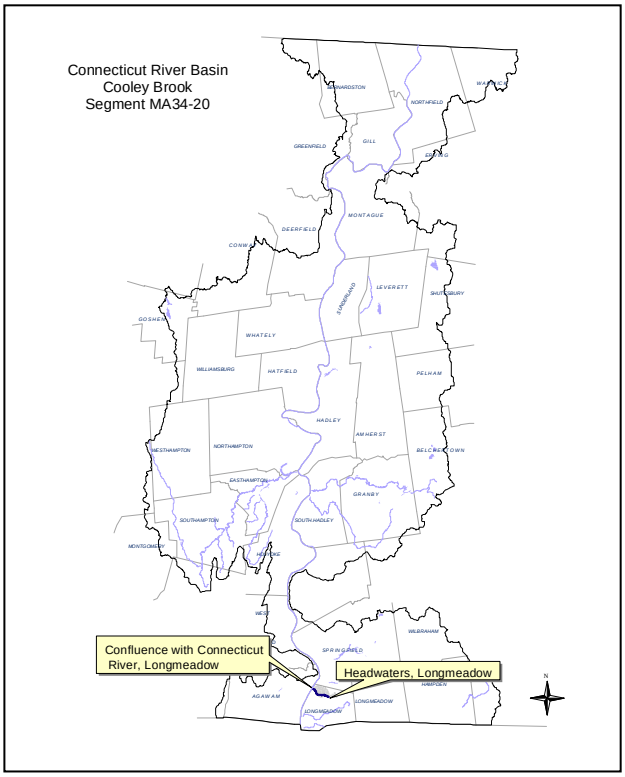
- MA0103331 – The Springfield Regional WWTP will be required to implement “9 Minimum Controls” as a condition of their new NPDES permit as well as to develop a long-range control plan to address abatement of impacts related to CSOs (Hogan 2000). Depending on the results of the Final CSO plan, the SWQS will need to be updated. If any CSO discharges are to remain, then a B (CSO) designation would be necessary (Brander 2000).

COOLEY BROOK (SEGMENT MA34-20)

Location: Headwaters, Longmeadow to confluence with Connecticut River, Longmeadow.
Segment Length: 1.4 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Residential	70%
Forest	22%
Open Land	4%



USE ASSESSMENT

Current data/information was not available therefore all uses for Cooley Brook (Segment MA34-20) are not assessed.

Cooley Brook (Segment MA34-20) Use Summary Table

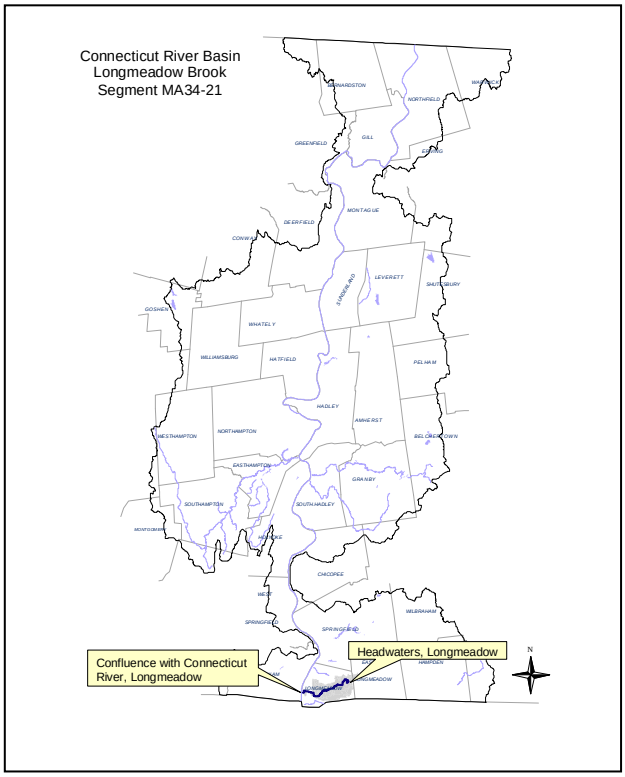
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

LONGMEADOW BROOK (SEGMENT MA34-21)

Location: Headwaters, Longmeadow to confluence with Connecticut River, Longmeadow.
Segment Length: 4.3 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Residential	55%
Forest	25%
Open Land	13%



USE ASSESSMENT

Current data/information was not available therefore all uses for Longmeadow Brook (Segment MA34-21) are not assessed.

Longmeadow Brook (Segment MA34-21) Use Summary Table

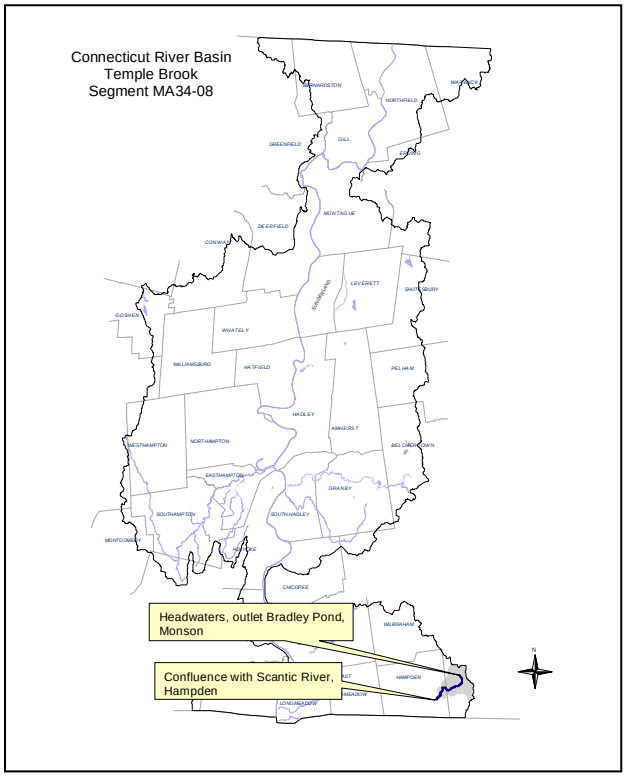
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

TEMPLE BROOK (SEGMENT MA34-08)

Location: Headwaters (outlet Bradley Pond), Monson to confluence with Scantic River, Hampden.
Segment Length: 2.80 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	88%
Agriculture	6%
Residential	4%



USE ASSESSMENT

Current data/information was not available therefore all uses for Temple Brook (Segment MA34-08) are not assessed.

Temple Brook (Segment MA34-08) Use Summary Table

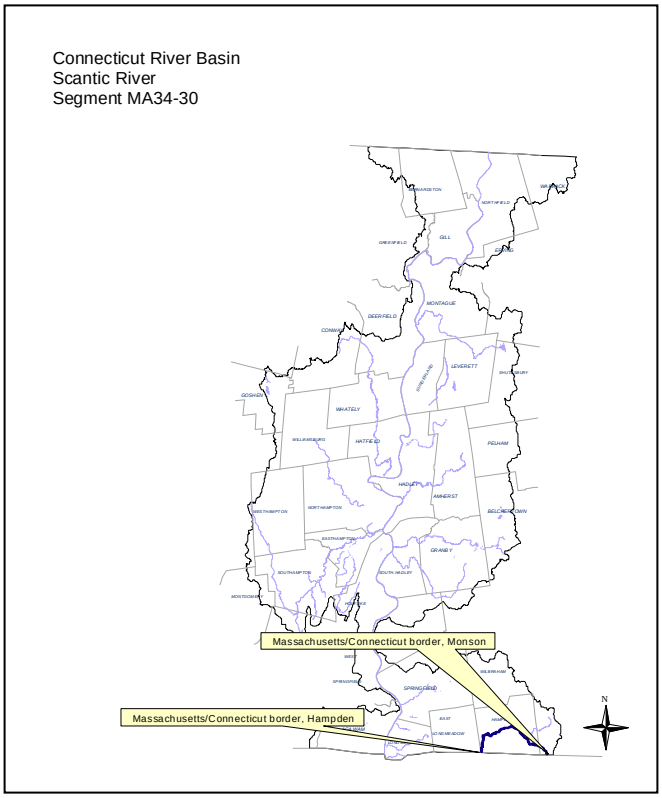
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

SCANTIC RIVER (SEGMENT MA34-30)

Location: From the Massachusetts/Connecticut border, Monson to the MA/CT border, Hampden.
Segment Length: 9.5 miles.
Classification: Class B.

Land-use estimates are not available for this subwatershed since most of its length is in Connecticut.

Data collection efforts have been conducted in the Scantic River by DWM as part of a Numeric Biocriteria project (97-09/104) as described in Appendix A. The analysis of the information has not yet been completed.



WATER WITHDRAWAL SUMMARY:

Facility	PWS ID#	WMA Permit #	WMA Registration #	Authorized Withdrawal	1999 Average Withdrawal
Mary Lyon Nursing Home, Hampden	1120001-01G 1120001-02G				0.010 MGD
Hampden Housing Authority, Hampden	1120002-01G				0.008 MGD
Hampden House Café, Hampden	1120004-01G				0.004 MGD
Laughing Brook Ed. Ctr. & Sanctuary, Hampden	1120005-02G				0
Green Meadows School, Hampden	1120011-01G				0.0006 MGD
White Birch Garden Apts., Hampden	1120015-01G 1120015-02G				0.0017 MGD
Timbro Mall, Hampden	1120017-01G				0.005 MGD
O'Connell Oil Convenience Plus, Hampden	1120021-01G				0.0008 MGD
2 Allen St. Prof. Bldg., Hampden	1120022-01G				0.0019 MGD
Scantic Valley Water District, Hampden	1120023-01G 1120023-02G				0.0015 MGD
Springfield Sportsman's Club, Monson	1191003-01G 1191003-02G				0
Total Withdrawals					*0.034 MGD*

USE ASSESSMENT

Current data/information was not available therefore all uses for the Scantic River (Segment MA34-30) are not assessed.

Scantic River (Segment MA34-30) Use Summary Table

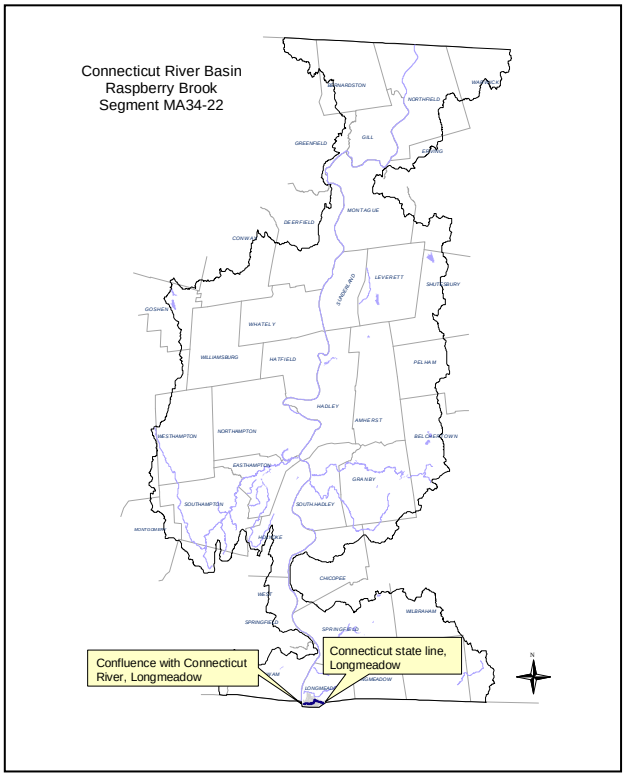
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RASPBERRY BROOK (SEGMENT MA34-22)

Location: from Connecticut state line to confluence with Connecticut River, Longmeadow
Segment Length: 1.8 miles.
Classification: Class B.

Major land-use estimates (top three uses) for the subwatershed (map inset, gray shaded area):

Forest	57%
Residential	25%
Agriculture	10%



USE ASSESSMENT

Current data/information was not available therefore all uses for Raspberry Brook (Segment MA34-22) are not assessed.

Raspberry Brook (Segment MA34-22) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

CONNECTICUT RIVER BASIN - LAKES

There are a total of 123 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) in the Connecticut River Basin with a total surface area of 3,342 acres. The 47 lakes surveyed in 1998 (Table 8) are located wholly or partly within 23 different communities and are fairly evenly distributed among them with the exception of Springfield where eight lakes were surveyed. Collectively, a total of 51 lakes (2815 acres) have been assessed historically (Table 10). Thirty-two of these lakes are less than 50 acres in total surface area. Designated water supplies (i.e., Class A) accounted for 26% (or 856 acres) of the assessed acreage. The remaining 67 lakes, 527 acres, in the Connecticut River Basin are unassessed.

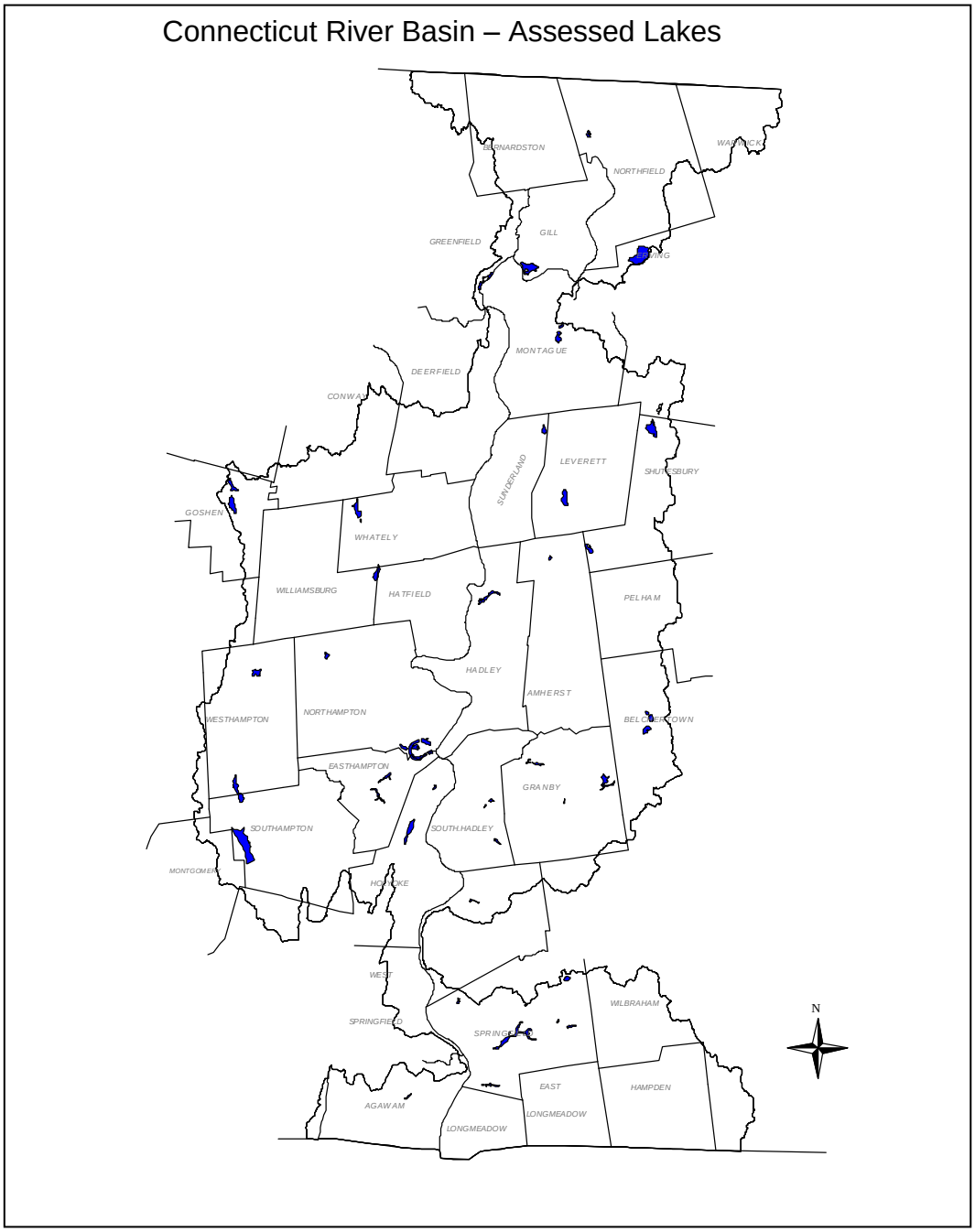


Figure 6. Connecticut River Basin Lakes Assessed in Massachusetts

LAKES DATA

Synoptic surveys were conducted by DWM during the summer of 1998 at 47 lakes in the Connecticut River Basin. Surveys consisted of taking observations from at least one access point on each lake (multiple access points on larger lakes). At each lake, an attempt was made to observe the entire surface area to determine the extent of areal macrophyte cover. The trophic status of each lake was estimated and the presence of non-native aquatic and/or wetland plant species was also noted (Table 8). The data gathered during these synoptic surveys, as well as MA DPH Fish Consumption Advisories (MA DPH 1999), were used to assess the status of the designated uses.

Table 8. DWM Summer 1998 Lake Survey Data (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	OBSERVATIONS, (Objectionable Conditions)
Aldrich Lake (east), Granby	34002	18.5	E	Duckweed along west and south shores
Aldrich Lake (west), Granby	34106	10.7	U	
Arcadia Lake, Belchertown	34005	40	U	Non-native plants (Cc, Mh); [ACT, '98 indicated very dense submergents in north end]
Atkins Reservoir **, Shutesbury	34006	52	U	Water level high, flooding terrestrial plants
Barton's Cove, Gill	34122	229	U	Non-native plants (Cc, Ms, Pc)
Cranberry Pond, Sunderland	34018	24	U	Non-native plants (Ms); south end of pond with dense to very dense plant growth
Danks Pond, Northampton/Easthampton	34019	5	E	Very little water in pond, about 1/3 filled, heavily vegetated
Forge Pond, Granby	34024	74.9	H	Non-native plants (Ls), very dense submergent vegetation and duckweed
Green Pond **, Montague	34028	12	U	Very clear; many frogs and tadpoles
Hulberts Pond, Northampton	34036	13	E	Water level down, about 5-15' of shore; water very turbid
Lake Bray, Holyoke	34013	12	U	Non-native plants (Ls, Pc); west end filling with emergents
Lake Holland, Belchertown	34035	12	U	Non-native plants (Cc, Mh)
Lake Lookout, Springfield	34044	7	E	Non-native plants (Ls); moderate turbidity; north and eastern sections with heavy vegetation; many geese on the lake
Lake Pleasant **, Montague	34070	50	U	
Lake Wyola, Shutesbury	34103	129	U	Occasional patches of floating vegetation in less developed sections of shore, particularly in southern cove
Leaping Well Reservoir, South Hadley	34040	11	E	Blue-green alga bloom in progress; some development to the N.E.
Leverett Pond, Leverett	34042	65	E	Non-native plants (Ms, Nm), southern end of lake is very densely covered with floating and encroaching emergents
Log Pond Cove (McNulty Park Pond), Holyoke	34124	19	U	Non-native plants (Tn), very dense
Loon Pond, Springfield	34045	25.4	U	Non-native plants (Ls)
Lower Highland Lake, Goshen	34047	88	U	
Lower Mill Pond, Easthampton	34048	32	E	Duckweed very dense at dam; northeast arm filled in
Lower Pond, South Hadley	34049	6	E	Non-native plants (Ls, Ms, Tn); algal mats, duckweed and submergents very dense; green/brown powdery scum; oil sheen

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e), Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pa = *Phragmites australis*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, Ls = *Lythrum salicaria*.

Table 8. Continued. DWM Summer 1998 Lake Survey Data (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	OBSERVATIONS, (Objectionable Conditions)
Metacomet Lake, Belchertown	34051	70	U	Non-native plants (Cc, Mh), oily sheen on surface; [ACT, '98 indicated some dense vegetation at the north end of the lake]
Mill Pond, Springfield	34052	15	H	Non-native plants (Ls): blue/green scum on N shore; duckweed and algal mats; dead fish smell; extensive vegetation along shores
Mountain Lake, Chicopee	34055	18	E	Oily brown sheen along windward shore; moderate turbidity; *Nitella* sp. and filamentous algae very dense; appears about 1/3 of pond is filled in
Mountain Street Reservoir **, Hatfield/Whately/ Williamsburg	34056	66	U	Occasional cattail stands along shore
Nashawannuck Pond, Easthampton	34057	31.3	E	Erosion off beach; moderate grey/ brown turbidity; bright green scum; floating and submergent aquatic plants along shore
Noonan Cove, Springfield	34058	4	E	Non-native plants (Ls); excessive brown turbidity; about half covered with duckweed
Northampton Reservoir **, Whately	34059	65	U	
Northfield Mountain Reservoir, Erving	34061	360	U	Non-native plants (Ls)
Oxbow, Easthampton/Northampton	34066	168	U	Excessive brown turbidity; water level low; 5-15' shore exposed
Pine Island Lake, Westhampton	34069	54	U	
Plympton Brook Pond	34071	15	E	Upper end of lake, southeast and much of eastern shore with dense to very dense floating aquatic plants
Porter Lake, Springfield	34073	28	E	Non-native plants (Ls, Nl); floating algal and duckweed mats at western end; E end filled in
Porter Lake West, Springfield	34072	5	E	Non-native plants (Ls, Nl); duckweed and alga dense on E, W and S shorelines; 4 spray aerators in center and west of pond
Roberts Meadow Reservoir **, Northampton	34076	23	U	Non-native plants (Pa)
Rubber Thread Pond, Easthampton	34105	5	H	Green scum of water meal; no visible open water
Sawyer Ponds [North Basin], Northfield	34078	9	E	Upper end and half of area near dam covered with dense floating vegetation
Sawyer Ponds [South Basin], Northfield	34079	12	E	Floating leaf plants in patches along N and W shores
Tighe Carmody Reservoir **, Southhampton	34089	354	U	Non-native plants (Pa)
Upper Highland Lake, Goshen	34093	53	U	Frequent *Sparganium* sp. around shore
Upper Pond, South Hadley	34095	11	E	Non-native plants (Tn); floating algal mats and water chestnuts near dam
Upper Van Horn Park Pond (Bold), Springfield	36158	9.6	H	Northwest coves with floating plants, duckweed and algal cover; encroaching cattails; southeast and E shores with algal mats and floating plants; moderate grey-green turbidity

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e), Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pa = *Phragmites australis*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, Ls = *Lythrum salicaria*.

Table 8. Continued. DWM Summer 1998 Lake Survey Data (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	OBSERVATIONS, (Objectionable Conditions)
Lake Warner, Hadley	34098	68	E	Frequent floating leaf beds close to shore; north end of lake with much duckweed cover
Watershops Pond, Springfield	34099	157	E	Non-native plants (Ls);excessive blue/green/ brown turbidity
White Reservoir **, Southhampton/Westhampton	34100	132	U	Pond has been drained to about 40' below top; only a small pool (1-2 acres) remains
Whiting Street Reservoir **, Holyoke	34101	102	U	Non-native plants (Ls, Ms); some dense growth of *M. spicatum* at south end

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e), Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pa = *Phragmites australis*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, Ls = *Lythrum salicaria*.

USE ASSESSMENT

AQUATIC LIFE

Of the 47 lakes surveyed, 13, or 28% had a confirmed non-native aquatic macrophyte observed. In the case of wetland species 14, or 30%, lakes had non-natives associated with them. A list of the two non-native wetland species and the seven non-native aquatic species observed in the Connecticut River Basin lakes, follows:

Non-native Wetland Plants

Lythrum Salicaria - Purple loosestrife
Phragmites australis - Reed grass

Non-native Aquatic Plants

Myriophyllum spicatum - Eurasian water milfoil
Myriophyllum heterophyllum – Variable milfoil
Najas minor - European naiad
Nelumbo lutea – American lotus
Potamogeton crispus - Curly leaf pondweed
Cabomba caroliniana – Fanwort
Trapa natans – Water chestnut

Non-native plant species represent a special cause of impairment that is not always directly related to the eutrophication process. Since these species are introduced from other parts of the country or world they are generally free from the natural control mechanisms (e.g., insects or diseases) that keep most native plant populations in check. Without controls the populations of many non-native species can grow rapidly to out-compete native plant species. This growth habit is termed invasive. It throws the biological community out of balance and can impair uses such as swimming (*Primary Contact*) and boating (*Secondary Contact*). In Massachusetts, the Division of Watershed Management is tracking the distribution of about a dozen of these non-native aquatic and wetland plant species and the impairment they are causing.

The distribution of these species is frequent to widespread, often in headwater areas, and since these species have good potential for spreading, it is likely that they have established themselves in unsurveyed lakes and segments of tributaries to the Connecticut River. The listings in Table 9 indicate where non-native, aquatic species have been observed (**in bold**) and the likely, or potential, avenues of downstream spreading.

Mechanical harvesting of water chestnut (*Trapa natans*) was conducted in the Connecticut River Basin as part of the 2000 Connecticut River Watershed Water Chestnut Control Activities. Funds for the mechanical harvesting projects came from the Region 5 Challenge Cost Share Program, the EOEA, and Holyoke Water Power (Boettner 2000). Silvio Conte National Fish and Wildlife Refuge, under a grant from the National Fish and Wildlife Foundation has provided coordination for many *T. natans* hand-pulling events. Since early detection is key to control, EOEA, through the Franklin, Hampden, and Hampshire Conservation Districts, have hired an intern who is recruiting volunteers to actively check water bodies for the presence of water chestnut within the Connecticut River Watershed. This "Invasive Plant Watch"

program was made possible by a grant from the Riverways Program and the local Conservation Districts (Boettner 2000).

Lakes exhibiting impairment of the *Aquatic Life Use* because of macrophyte cover were noted as either partial or non-support (Table 10). However, if a lake met these criteria it, or part of its area, was listed as "not assessed" because no dissolved oxygen data were available.

FISH CONSUMPTION

The current MA DPH fish consumption advisory for the Connecticut River recommends that "Children under 12 years of age, pregnant women, and nursing mothers should not consume any fish from the Connecticut River (all towns between Northfield and Longmeadow) and the general public should not consume channel catfish, white catfish, American eel or yellow perch (all towns between Northfield and Longmeadow) because of PCB contamination" (MA DPH 1999). This advisory is applicable to Barton's Cove in Gill and Log Pond Cove (also known as McNulty Park Pond) in Holyoke, embayments of the Connecticut River (Table 10). Additionally, in 1994, MA DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption (MA DPH 1994).

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

Because the synoptic surveys focus on just three criteria (macrophyte cover, transparency, and biocommunity modifications) only a few uses could be assessed fully (Table 10). Since macrophyte cover is the only criterion used to assess the *Secondary Contact Recreation*, this use category was assessed at each lake surveyed (Table 10). Lakes exhibiting impairment of the *Primary Contact Recreation Use* (swimming) because of macrophyte cover and/or transparency were noted as being either partial or non-support. It should be mentioned, however, that no fecal coliform bacteria data were made available to evaluate the status of either the primary or secondary contact recreational uses. Therefore, if a lake met the macrophyte cover, transparency, and biocommunity modifications criteria, it (or part of its area) was not assessed.

The same criteria used to assess the recreational uses were also used to assess the *Aesthetic Use.* This use, therefore, was generally assessed at the same level of impairment as the more severely impaired recreational use (*Primary* or *Secondary Contact Recreation*).

Table 9. Non-native aquatic plant species locations (**in bold**) in the Connecticut River Basin and their possible paths of downstream spreading (MA DEP 1998).

Cabomba caroliniana **(Fanwort)**

-- Lake Holland (Belchertown) ⇒ **Arcadia Lake** (Belchertown) ⇒ **Metacomet Pond** (Belchertown) ⇒ Bachelor Brook (through Forge Pond, Aldrich Lake, east and west basins, an unnamed pond near Moody Corner, Granby, and Pearl City Pond, S. Hadley) ⇒ Connecticut River

-- Barton's Cove (Gill) ⇒ Connecticut River south

Myriophyllum heterophyllum **(Variable water milfoil)**

-- Lake Holland (Belchertown) ⇒ **Arcadia Lake** (Belchertown) ⇒ **Metacomet Pond** (Belchertown) ⇒ Bachelor Brook (through Forge Pond, Aldrich Lake, east and west basins, an unnamed pond near Moody Corner, Granby, and Pearl City Pond, S. Hadley) ⇒ Connecticut River

Myriophyllum spicatum **(Eurasian water milfoil)**

-- **Barton's Cove** (Gill) ⇒ Connecticut River south

-- Cranberry Pond (Sunderland) ⇒ Cranberry Pond Brook ⇒ Connecticut River

-- **Leverett Pond** (Leverett) ⇒ Unnamed tributary ⇒ Doolittle Brook ⇒ Cushman Brook (through a small unnamed impoundment and Factory Hollow Pond, Amherst) ⇒ unnamed tributary ⇒ Mill River (through Lake Warner, Hadley) ⇒ Connecticut River

-- **Lower Pond** (South Hadley) ⇒ Stony Brook ⇒ Connecticut River

-- **Whiting Street Reservoir** (Holyoke) ⇒ unnamed tributary (through unnamed pond in Wyckoff Country Club) ⇒ presumably an uncertain subsurface route to the Connecticut River

Najas minor **(European naiad)**

-- **Leverett Pond** (Leverett) ⇒ Unnamed tributary ⇒ Doolittle Brook ⇒ Cushman Brook (through a small unnamed impoundment and Factory Hollow Pond, Amherst) ⇒ unnamed tributary ⇒ Mill River (through Lake Warner, Hadley) ⇒ Connecticut River

Nelumbo lutea **(American lotus)**

-- Porter Lake (Springfield) ⇒ **Porter Lake West** (Springfield) ⇒ through several other small unnamed ponds in Forest Park ⇒ unnamed tributary ⇒ Connecticut River

Potamogeton crispus **(Curly leaf pondweed)**

-- **Barton's Cove** (Gill) ⇒ Connecticut River south

-- **Lake Bray** (Holyoke) ⇒ unnamed tributary (through Kennedy Pond)_⇒ Connecticut River

Trapa natans **(Water chestnut)**

-- **Forge Pond** (Granby) ⇒ Bachelor Brook (through Aldrich Lake, east and west basins, an unnamed pond near Moody Corner, Granby, and Pearl City Pond, S. Hadley) ⇒ Connecticut River

-- Log Pond Cove (also known as McNulty Park Pond) (Holyoke) ⇒ Connecticut River

-- Upper Pond (South Hadley) ⇒ **Lower Pond** (South Hadley) ⇒ Stony Brook ⇒ Connecticut River

-- **Lake Warner** (Hadley) ⇒ Mill River ⇒ Connecticut River

-- **Whiting Street Reservoir** (Holyoke) ⇒ unnamed tributary (through unnamed pond in Wyckoff Country Club) ⇒ presumably an uncertain subsurface route to the Connecticut River

Table 10. Assessment of Connecticut River Basin Lakes (MA DEP 1998). (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT (Acres)	IMPAIRMENT CAUSE(S)
Aldrich Lake (east), Granby	34002	18.5	E	1° Contact- N(4); U(14.5) 2° Contact- S(14.5); N(4) Aesthetics- S(14.5); N(4)	Noxious plants
Aldrich Lake (west), Granby	34106	10.7	U	2°Contact-S(6); U(4.7) Aesthetics-S(6); U(4.7)	
Arcadia Lake, Belchertown	34005	40	U	ALUS- P(40) 1° Contact- N(10); U(30) 2° Contact- S(30); N(10) Aesthetics- S(30); N(10)	Non-native plants (Cc, Mh) Noxious plants
Atkins Reservoir**, Shutesbury	34006	52	U	2° Contact- S(52) Aesthetics- S(52)	
Barton's Cove, Gill	34122	229	U	ALUS- P(229) Fish consumption- N(229) 2° Contact- S(229) Aesthetics- S(229)	Priority organics (PCB) Non-native plants (Cc,Ms,Pc)
Cranberry Pond, Sunderland	34018	24	U	ALUS- P(24) 1° Contact- N(12); U(12) 2° Contact- S(12); N(12) Aesthetics- S(12); N(12)	Non-native plants (Ms) Noxious plants
Danks Pond, Northampton/ Easthampton	34019	5	E	1° Contact- N(5) 2° Contact- N(5) Aesthetics- N(5)	Noxious plants
Factory Hollow Pond, Amherst	34021	11	U	Not Assessed	
Forge Pond, Granby	34024	74.9	H	ALUS- P(74.9) 1° Contact- N(15); U(59.9) 2° Contact- S(44.9); N(15); U(15) Aesthetics- S(44.9); N(15); U(15)	Non-native plants (Tn) Noxious plants
Green Pond**, Montague	34028	12	U	2° Contact- S(12) Aesthetics- S(12)	
Hulberts Pond, Northampton	34036	13	E	1° Contact- N(10); U(3) 2° Contact- S(3); N(10) Aesthetics- S(3); N(10)	Noxious plants Flow alteration
Ingraham Brook Pond, Granby	34037	5	U	Not Assessed	
Lake Bray, Holyoke	34013	12	U	ALUS- P(12) 2° Contact- S(12) Aesthetics- S(12)	Non-native plants (Pc)
Lake Holland, Belchertown	34035	12	U	ALUS- P(12) 2° Contact- S(12) Aesthetics- S(12)	Non-native plants (Cc, Mh)
Lake Lookout, Springfield	34044	7	E	1° Contact- P(4); N(3) 2° Contact- P(4); N(3) Aesthetics- P(4); N(3)	Turbidity Noxious plants
Lake Pleasant**, Montague	34070	50	U	2° Contact- S(50) Aesthetics- S(50)	
Lake Wyola, Shutesbury	34103	129	U	2° Contact- S(129) Aesthetics- S(129)	
Leaping Well Reservoir, South Hadley	34040	11	E	1° Contact- P(11) 2° Contact- P(11) Aesthetics- P(11)	Noxious plants
Leverett Pond, Leverett	34042	65	E	ALUS- P(65) 1° Contact- N(49); U(16) 2° Contact- N(49); U(16) Aesthetics- N(49); U(16)	Non-native plants (Ms) Noxious plants

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e), Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Use Attainment—S = Support, P = Partial support, N = Non-support, NA = Not attainable, U = Undetermined/not assessed.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, *Cc = Cabomba caroliniana*
[Note: This table only includes lakes in the Connecticut River Basin that are in the DEP/EPA Water Body System (WBS) database.]

Table 10. Continued. Assessment of Connecticut River Basin Lakes (MA DEP 1998). (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT (Acres)	IMPAIRMENT CAUSE(S)
Log Pond Cove (McNulty Park Pond), Holyoke	34124	19	U	ALUS- P(19) Fish Consumption- N(19)	Non-native plants (Tn) Priority organics (PCB)
Loon Pond, Springfield	34045	25.4	U	2° Contact- S(25.4) Aesthetics- S(25.4)	
Lower Highland Lake, Goshen	34047	88	U	2° Contact- S(88) Aesthetics- S(88)	
Lower Mill Pond, Easthampton	34048	32	E	2° Contact- S(32) Aesthetics- S(32)	
Lower Pond, South Hadley	34049	6	E	ALUS- P(6) 1° Contact- N(6) 2° Contact- N(6) Aesthetics- N(6)	Non-native plants (Ms,Tn) Noxious plants
Metacomet Lake, Belchertown	34051	70	U	ALUS- P(70) 2° Contact- S(70) Aesthetics- S(70)	Non-native plants (Cc, Mh)
Mill Pond,Springfield	34052	15	H	1° Contact- P(9); N(6) 2° Contact- P(9); N(6) Aesthetics- P(9); N(6)	Taste and odor Noxious plants
Mountain Lake, Chicopee	34055	18	E	1° Contact- P(12); N(6) 2° Contact- P(12); N(6) Aesthetics- P(12); N(6)	Turbidity Noxious plants
Mountain Street Reservoir ** Hatfield/ Whately/ Williamsburg	34056	66	U	2° Contact- S(66) Aesthetics- S(66)	
Nashawannuck Pond, Easthampton	34057	31.3	E	1° Contact- P(31.3) 2° Contact- P(31.3) Aesthetics- P(31.3)	Turbidity
Noonan Cove, Springfield	34058	4	E	1° Contact- P(2); N(2) 2° Contact- P(2); N(2) Aesthetics- P(2); N(2)	Turbidity Noxious plants
Northampton Reservoir**, Whately	34059	65	U	2° Contact- S(65) Aesthetics- S(65)	
Northfield Mountain Reservoir, Erving	34061	360	U	2° Contact- S(360) Aesthetics- S(360)	
Oxbow, Easthampton/ Northampton	34066	168	U	1° Contact- P(168) 2° Contact- P(168) Aesthetics- P(168)	Turbidity
Pine Island Lake, Westhampton	34069	54	U	2° Contact- S(54) Aesthetics- S(54)	
Plympton Brook Pond, Wendell	34071	15	E	1° Contact- N(11); U(4) 2° Contact- S(4); N(11) Aesthetics- S(4); N(11)	Noxious plants
Porter Lake, Springfield	34073	28	E	ALUS- P(22); NA(6) Fish consumption- NA(6) 1° Contact- NA(6) 2° Contact- S(22); NA(6) Aesthetics- S(22); NA(6)	Non-native plants (Nl) Noxious plants
Porter Lake West, Springfield	34072	5	E	ALUS- P(5) 1° Contact- N(2); U(3) 2° Contact- S(3); N(2) Aesthetics- S(3); N(2)	Non-native plants (Nl) Noxious plants
Roberts Meadow Reservoir**, Northampton	34076	23	U	2° Contact- S(23) Aesthetics- S(23)	

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e),
Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Use Attainment—S = Support, P = Partial support, N = Non-support, NA = Not attainable, U = Undetermined/not assessed.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, *Cc* = *Cabomba caroliniana*
[Note: This table only includes lakes in the Connecticut River Basin that are in the DEP/EPA Water Body System (WBS) database.]

Table 10. Continued. Assessment of Connecticut River Basin Lakes (MA DEP 1998). (**Bold** indicates 1998 303(d) listed lakes).

LAKE, LOCATION	PALIS #	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT (Acres)	IMPAIRMENT CAUSE(S)
Rubber Thread Pond, Easthampton	34105	5	H	1° Contact- N(5) 2° Contact- N(5) Aesthetics- N(5)	Noxious plants
Sawyer Ponds [North Basin], Northfield	34078	9	E	1° Contact- N(9) 2° Contact- N(9) Aesthetics- N(9)	Noxious plants
Sawyer Ponds [South Basin], Northfield	34079	12	E	2° Contact- S(12) Aesthetics- S(12)	
Silver Lake (Porter Lake), Agawam	34084	10	U	Not Assessed	
Tighe Carmody Reservoir **, Southampton	34089	354	U	2° Contact- S(354) Aesthetics- S(354)	
Upper Highland Lake, Goshen	34093	53	U	2° Contact- S(53) Aesthetics- S(53)	
Upper Pond, South Hadley	34095	11	E	ALUS- P(11) 2° Contact- S(11) Aesthetics- S(11)	Non-native plants (Tn)
Upper Van Horn Park Pond (bold), Springfield	36158	9.6	H	1° Contact- P(5.6); N(4) 2° Contact- P(5.6); N(4) Aesthetics- P(5.6); N(4)	Turbidity Noxious plants
Venture Pond, Springfield	34096	8	U	Not Assessed	
Lake Warner, Hadley	34098	68	E	ALUS- P(68) 1° Contact- N(24); U(44) 2° Contact- S(44); N(24) Aesthetics- S(44); N(24)	Non-native (Tn) Noxious plants
Watershops Pond, Springfield	34099	157	E	1° Contact- P(157) 2° Contact- P(157) Aesthetics- P(157)	Turbidity
White Reservoir**, Southampton/ Westhampton	34100	132	U	ALUS- NA(132) Fish consumption-NA(132) 1° Contact- NA(132) 2° Contact- NA(132) Aesthetics- NA(132)	Flow alteration
Whiting Street Reservoir**, Holyoke	34101	102	U	ALUS- P(102) 2° Contact- S(102) Aesthetics- S(102)	Non-native plants (Ms, Tn)

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: PALIS # -- Pond and Lake Identification System code number (Ackerman 1989 and MA DEP 2000e), Trophic State --- H = Hypereutrophic, E = Eutrophic, M = Mesotrophic, U = Undetermined.
Use Attainment—S = Support, P = Partial support, N = Non-support, NA = Not attainable, U = Undetermined/not assessed.
Non-native Plants – Mh = *Myriohyllum heterophyllum*, Ms = *Myriophyllum spicatum*, Nm = *Najas minor*, Nl = *Nelumbo lutea*, Pc = *Potamogeton crispus*, Tn = *Trapa natans*, *Cc* = *Cabomba caroliniana*
[Note: This table only includes lakes in the Connecticut River Basin that are in the DEP/EPA Water Body System (WBS) database.]

SUMMARY

Due to the focus of the surveys conducted, the major cause of impairment was aquatic plants (either noxious-native or non-native). Turbidity was also noted occasionally as a cause (Table 10). These causes may reflect symptoms of lake succession, a process of enrichment that can be accelerated from excessive plant nutrients and sediments being introduced to the lakes from cultural activities. This phenomenon is also reflected in the distribution of lake trophic conditions, where reported, which is skewed toward the more eutrophic categories. Additional causes of impairment include priority organics (PCB) associated with the MA DPH fish consumption advisories, flow alteration, and objectionable taste/odor.

The sources of impairment are largely unknown, at least based on direct knowledge. However, it can be surmised that nutrients delivered from storm water runoff, failing substandard sewage disposal systems, and other non-point sources are likely to cause the increased algal or macrophyte productivity that has resulted in impairments.

With the above qualifications for the individual use assessments of lake resources in the Connecticut River Basin, approximately 49% of the surveyed surface acreage of lakes is impaired. Two (Ingraham Brook Pond, Granby and Venture Pond, Springfield) of four lakes listed as not assessed in Table 10 are on the 1998 303(d) list.

RECOMMENDATIONS – LAKES

- As part of the 2000 Connecticut River Watershed Water Chestnut Control Activities, *T. natans* harvesting has been conducted by both hand-pulling and mechanical harvesting. Continue to monitor, conduct and support these activities and evaluate their effectiveness.

- Additionally, non-native aquatic or wetland plant species that were isolated to one or a few location(s) quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations, to determine the extent of the infestation. And, "spot" treatments should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand pulling individual plants, in small areas, or selective herbicide applications in larger areas. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These cautions will minimize the spreading of the populations.

- As with the isolated cases, a program to manage the more extensive plant infestations should include additional monitoring efforts to determine the extent of the problem. Plant control aspects of any plan to manage the non-native aquatic species mentioned above can select from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.), each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for these plants to reproduce and spread vegetatively (from cuttings).

- Another important component of a management plan is prevention of further spreading of these plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations occurring in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

- Diagnostic/feasibility (D/F) studies have been conducted on seven lakes in the Connecticut River Basin. These include: Arcadia Lake in Belchertown, Forge Pond in Granby, Loon Pond in Springfield, Metacomet Lake in Belchertown, Nashawannuck Pond in East Hampton, Porter Lake in Springfield and Watershops Pond in Springfield. Each of these studies has recommendations to deal with watershed and in-lake issues specific to the waterbody. Whether or not the recommendations have been implemented is unknown, although they should still be applicable and merit implementation. One project is currently underway in the Connecticut River Basin (MA DEP 2000b):

  P98-05/319 *Nashawannuck Pond Watershed Restoration.* Nashawannuck Pond has been reduced in size by sedimentation, and heavy phosphorus loading resulting from this constant sediment loading is accelerating aquatic weed growth. This project is currently implementing recommendations of a 1990 D/F study, and building upon previous activities to improve the water quality of the pond. Additional 319 funding has been provided in 2000 to implement stormwater BMPs and other recommendations identified in the D/F study.

- Conduct sampling to evaluate the effectiveness of the BMPs implemented at Nashawannuck Pond in East Hampton in conjunction with DEP's 319 project.

Coordinate with DEM to generate quality assured lakes data and conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment.

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APPENDIX A -- MA DEP 2001 GRANT AND LOAN PROGRAMS

MA DEP GRANT AND LOAN PROGRAMS

The MA DEP grant and loan programs consist of federal funds from EPA as authorized by the Clean Water Act (sections 604B, 104(b)(3) and 319, and the Drinking Water State Revolving Fund (DWSRF) Set-asides). Other programs are derived through state appropriation. These include the state bond fund for research and demonstration and state loan programs for municipalities (state revolving loan fund, SRF) and homeowners (community septic management program). Each of these programs provides an opportunity for watershed initiative planning and/or implementation. Other governmental agencies (CZM, EPA, etc.) also offer water quality related funding through grant and loan programs. For further information on MA DEP managed grant and loan programs refer to Appendix B of this report.

Excerpted from the MA DEP/DWM World Wide Web site, http://www.state.ma.us/dep/brp/wm/wmpubs.htm#other '2001 Grant and Loan Programs - Opportunities for Watershed Planning and Implementation'.

604(b) WATER QUALITY MANAGEMENT PLANNING GRANT PROGRAM

This grant program is authorized under the federal Clean Water Act Section 604(b) for water quality assessment and management planning. 604(b) projects in the Connecticut River Watershed include:

- 96-03/604 *An Assessment of Urban Stream Restoration: Tannery Brook* (Pioneer Valley Planning Commission 1999). The project, conducted between 1996 and 1998 by the Pioneer Valley Planning Commission, was conducted to identify potential watershed management practices that will restore water quality in Tannery and Poor Brooks, two degraded urban streams, to a more natural condition. The project will utilize a comprehensive watershed management approach to assess measures that address stormwater runoff, erosion and sedimentation, wetland degradation, and flooding by using restoration and stormwater control measures.

- 96-06/604 *Assessment and Evaluation of Stormwater Source Reduction Practices on Combined Sewer Overflows.* This project conducted between 1997 and 1998 by the Pioneer Valley Planning Commission, to assess the potential impacts of stormwater source reduction projects on a specified Combined Sewer Overflow (CSO) outfall point using a hydraulic model to predict the likelihood of CSO events under different stormwater reduction scenarios. The modeling results were then to be analyzed to determine the extent to which stormwater best management practices (BMPs) can achieve significant reductions in CSO volume and frequency, an develop a recommended stormwater management plan for the study area. Comparative cost estimates will be used to evaluate the relative advantages and disadvantages of a source reduction approach to CSO abatement, and to develop the recommended stormwater management plan.

- 97-01/604 *Stream Classification and Assessment.* This project proposes to use the Rosgen Stream Classification and Assessment Methodology to generally classify and assess stream types in the Deerfield and Connecticut River Basins, to collect data at selected sites on different stream types, and to establish an inventory of different stream types for reference and educational purposes. The resulting information will be used to make predictions about stream behavior, anticipate problems in the watershed as a result of certain land-uses, identify areas in need of restoration, distinguish between natural stream migration and evidence of stream instability, and improve overall ability to make good watershed planning decisions based on the stability and types of streams in the watershed.

104(b)(3) WETLANDS AND WATER QUALITY GRANT PROGRAM

This Grant Program is authorized under Wetlands and Clean Water Act Section 104(b)(3) of the federal Clean Water Act. The Water Quality proposals received by MA DEP under this National Environmental Performance Partnership Agreement (NEPPA) with the U.S. Environmental Protection Agency is a results oriented approach that will focus attention on environmental protection goals and the efforts to achieve them. The goals of the NEPPA are to: 1) achieve clean air, 2) achieve clean water, 3) protect wetlands, 4) reduce waste generation, and 5) clean up waste sites.

- 97-09/104 *Numeric Biocriteria.* This proposal is designed to address two issues relating to the current Biocriteria Pilot Study; specifically, to evaluate subecoregion difference in stream biota, if any, and formulate the biological indicators (fish and macroinvertebrates) that are essential to assess conditions and monitor changes in streams. Study expects to establish reference streams in 5 of the 13 Massachusetts Ecological Subregions. The study streams are located in the Connecticut, Westfield, Chicopee, Millers and Quinebaug River Basins.

  In the Connecticut River Basin, four streams were sampled as part of this project.
  1. Roberts Meadow Brook, 200m upstream of North Road, Westhampton
  2. East Branch Mil River, 100m downstream of Bullard Road, Williamsburg
  3. Roaring Brook, 125m upstream of Roaring Brook Road, Conway
  4. Scantic River, 115m downstream of Hancock Road, Hampden

  A brief overview of the sampling effort:

Subecoregion	Candidate Reference Stream	Station	Benthic Macroinvertebrate	Fish Population	*Insitu* Hydrolab Measurements
Vermont Piedmont	Roaring Brook	VP06ROA VP03ROA	4 Sept 1996 24 Sept 1997	24 Sept 1996 29 Sept 1997	24 Sept 1996 29 Sept 1997
Berkshire Transition	East Branch Mill River	BT10EMB	23 Sept 1997	25 Sept 1997	25 Sept 1997
Berkshire Transition	Roberts Meadow Brook	BT09RMB	23 Sept 1997	24 Sept 1997	24 Sept 1997
Lower Worcester Plateau – Eastern Connecticut Upland	Scantic River	LW05SCA	14 Sept 1998	16 Sept 1998[5]	16 Sept 1998

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- 98-10/104 *Connecticut River Land use & Nutrient Study.* This project collected water quality and hydrologic data from selected sub-basins with uniform land use in the Connecticut River Basin. These data will be used to refine nutrient loadings expected from selected land uses. The information generated from this study will assist the Department to better identify nutrient sources and prioritize those for mitigation.

319 NONPOINT SOURCE GRANT PROGRAM

This grant program is authorized under Section 319 of the CWA for implementation projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution. In order to be considered eligible for funding projects must: implement measures that address the prevention, control, and abatement of NPS pollution; target the major source(s) of nonpoint source pollution within a watershed/subwatershed; have a 40 percent non-federal match of the total project cost (match funds must meet the same eligibility criteria as the federal funds); contain an appropriate method for evaluating the project results; address activities that are identified in the Massachusetts NPS Management Program Plan.

Specific to the Connecticut River Basin -- In the spring of 1994, the Franklin County Commission convened a group of stakeholders to take up the problem of erosion in the Turners Falls Power Pool (Franklin Regional Council of Governments and Connecticut River Streambank Erosion Committee 1999). The Connecticut River Streambank Erosion Committee (CRSEC) is comprised of local officials, state and federal agencies, landowners, and utility representatives. A Draft Environmental Impact Report was prepared containing a proposal for the stabilization of several thousand feet of riverbank using soil bioengineering techniques. This proposal was accepted and permitted, and the utility committed $1.2 million over six years toward the project. A plan of action called the Phase I Work Plan was drafted and agreed to by all parties. The Franklin County Commission, now the Franklin Regional Council of Governments, also received $142,000 in s.319 non-point source implementation funding in order to

monitor, document and report on the project; to staff the CRSEC; and to provide funding for construction for one of the sites.

- 96-03/319 *Connecticut River Watershed Restoration.* Bioengineering techniques were used to repair eroded streambank in the upper Connecticut River at Turners Falls Power Pool. Implementation of these techniques will reduce sedimentation and the release of erosion-induce pollutants into the river. The project will demonstrate bioengineering on a large river with steep banks; previous bioengineering projects funded under the Department's S.319 program have been conducted on small low-order streams.

- 00-04/319 *Connecticut River Watershed Restoration Phase II.* Continue bioengineering streambank stabilization begun in 96-03/319. Streambank stabilization will be done at the Turners Falls Power Pool between Turners Falls and the Vermont/New Hampshire border using native vegetation and natural materials.

- 00-04/319 *Connecticut River Streambank Restoration.* This project will continue bioengineering streambank stabilization begun (96-03/319). Streambank stabilization will be done at the Turners Falls Power Pool, extending from Turners Falls tot he VT/NH border which is experiencing severe erosion. This nonpoint source pollution is affecting important anadromous and freshwater fisheries habitat and is also causing the loss of prime agricultural land and the loss of woody riparian buffer habitat used by migratory birds, eagles and other wildlife. Bioengineering techniques using native vegetation and natural materials to stabilize eroding sites will be employed. The project will also include continued monitoring of the previously completed stabilization project funded through the 39 program.

- 98-05/319 *Nashawannuck Pond Watershed Restoration.* Nashawannuck Pond has been reduced in size by sedimentation, and heavy phosphorus loading resulting from this constant sediment loading is accelerating aquatic weed growth. This project will implement recommendations of a 1990 Diagnostic/Feasibility study, and build upon previous activities to improve the water quality of the pond.

- 01-09/319 *Nashawannuck Pond Restoration Phase II.* This project will design and install stormwater BMPs on Broad Brook and the eastern shoreline of the pond to reduce sediment and nutrient loads to the pond and a vacuum system for their maintenance will be purchased. This restoration will expand on the work done to stabilize the banks of Nashuwannuck Pond proper in project 98-05/319.

- 99-08/319 *Mill River Watershed Restoration Project.* This project will permanently stabilize portions of the Mill River riverbank using soil bioengineering techniques. This will prevent erosion which currently threatens the Whately Water Department's water supply well and a monitoring well, and will preserve the values of the natural stable stream form. Because of the difficulties associated with siting and developing any water supply source and the lack of a clear alternative site for the Whately Water Department, relocating the wells would be difficult. In addition, a cut through the meander bend at this location may establish a pattern of instability that will spread upstream as a "head cut" resulting from the change in gradient brought about by the channel shortening. Repair of the bank will not only protect a critical drinking water supply, but it will also prevent what is now a localized instability from spreading through the watershed.

RESEARCH AND DEMONSTRATION GRANT PROGRAM

The Research and Demonstration Program (R&D) is authorized by section 38 of Chapter 21 of the Massachusetts General Laws and is funded by proceeds from the sale of Massachusetts bonds. Specifically, the R&D Program was established to enable the Department to conduct a program of study and research and demonstration relating to water pollution control and other scientific and engineering studies "...so as to insure cleaner waters in the coastal waters, rivers, streams, lakes and ponds of the Commonwealth." A wetland restoration planning project is currently underway in selected subwatershed of the Connecticut River Basin funded jointly by this program and the Army Corps of Engineers under Section 122.

SOURCE WATER AND TECHNICAL ASSISTANCE/LAND MANAGEMENT GRANT PROGRAM
The Source Water Protection Technical Assistance/Land Management Grant Program provides funds to *third party* technical assistance organizations that assist public water suppliers in protecting local and regional ground and surface drinking water supplies.

- 99-10/SWT *Running Gutter Reservoir Source Water Protection Project.* This project will develop a Surface Water Supply Protection Plan for the Running Gutter Reservoir, currently providing approximately 60 – 100% of Hatfield's water requirements. As development encroaches on crucial areas for this water supply, a completed plan will provide guidance and implementation tools for the town to use in protecting its water supply.

- 99-13/SWT *Roaring Brook Reservoir Source Water Protection Project.* This project will develop a Surface Water Supply Protection Plan to provide guidance and implementation tools for the South Deerfield Water Supply District. The Roaring Brook Reservoir System, comprising the Roaring Brook and Conway Reservoirs, represents the primary source of water for the District. Under normal conditions, it is the sole source of water because of identified contamination of the wellfield. This project will be conducted in concert with the Department's SWAP program, and will incorporate an educational program that targets residents, public officials, community groups, businesses, agricultural entities, and others.

- 00-09/SWT *Source Water Protection Project.* This project will develop a protection plan for Atkins Reservoir and update Amherst's Timber Stand Inventory.

WELLHEAD PROTECTION GRANT PROGRAM
The Wellhead Protection Grant Program provides funds to assist public water suppliers in addressing wellhead protection through local projects and education.

- 99-18/WHP *Erving Wellhead Protection Project.* This project will develop a Wellhead Protection Plan and an Emergency Response Plan, install four additional monitoring wells (to track previously identified potential contamination sources), develop a database for groundwater monitoring program to protect western Erving's sole groundwater well.

- 00-01/WHP *Green Meadows Wellhead Protection Project.* This project will replace sewer lines in the Zone I of the school's drinking water supply. Project includes replacing sewer lines; cleaning a stormwater drainpipe; and replacing manholes and septic tank components.

- 00-10/WHP *Hadley Wellhead Protection Project.* This project will install protective fencing around town of Hadley's wells.

- 00-15/WHP Whately Wellhead Protection Project. This project will develop a Wellhead Protection Plan and install a lightning protection system for the water systems equipment.

APPENDIX B -- CONNECTICUT RIVER FISH TOXICS MONITORING

BACKGROUND INFORMATION

Sampling of fish from the mainstem Connecticut River in 1985 was conducted by the Massachusetts Department of Environmental Quality Engineering (DEQE) Division of Water Pollution Control (MDWPC) Technical Services Branch (TSB) (now the Massachusetts Department of Environmental Protection Division of Watershed Management MA DEP DWM) at the request of the United States Fish and Wildlife Service (USFWS) (Maietta 1986). Composite samples of five whole fish collected from two reaches in Massachusetts (in addition to other reaches in Connecticut), the Connecticut River above the Holyoke Dam and the Chicopee River area, were analyzed for metals, PCB and other organics to assess levels of pollutants in fish tissue. Based on the results of this sampling, additional monitoring was performed by MDWPC in 1987.

Channel catfish *Ictalurus punctatus*, and white catfish *Ameiurus catus* were collected from three stations on the Connecticut River mainstem in an effort to verify suspected PCB problems in the river (Maietta 1998). Sampling was conducted above the Turner's Falls Dam, and above and below the Holyoke Dam. The edible fillets of individual fish were analyzed for metals, PCB and other organics and percent lipids. The data were provided to the Massachusetts Department of Public Health (MA DPH) for review. In April 1988 the MA DPH issued the following advisory:

> The Department of Public Health has reviewed toxic contaminant data generated by the Department of Environmental Quality Engineering for channel catfish taken from the Connecticut River in 1987. It has been determined that this species contains elevated levels of polychlorinated biphenyls (PCBs). Catfish have been identified as a fish in which PCBs are routinely found at higher levels than most other fish. The average level of PCBs in the catfish sampled is below the current federal Food and Drug Administration Action Level of 2.0 ppm. The primary health concern associated with exposure to PCBs is it's potential cancer risk since these compounds have been shown to cause cancer in laboratory animals.
>
> MA DPH RECOMMENDATIONS
>
> 1. Consumption of catfish (channel and white) from the Connecticut River should be limited to two meals per month per person.
>
> 2. Children, women of childbearing age, and nursing mothers should not eat any catfish from the Connecticut River, in order to minimize PCB body burdens.

As a result of the issuance of this advisory, MDWPC re-sampled the Connecticut River in 1988 in an attempt to collect and analyze other species desirable by fishermen and to expand the sampling area upstream of the Turner's Falls Dam (Maietta 1989). A total of four stations along the mainstem Connecticut River were sampled; south of the Vernon, VT dam, between the French King Bridge and Barton Cove in Gill, adjacent to the Oxbow in Northampton, and south of the Holyoke Dam in Chicopee. In addition to channel and/or white catfish, white sucker *Catostomus commersoni*, walleye *Stizostedion vitreum*, smallmouth bass *Micropterus dolomieu*, yellow perch *Perca flavescens*, chain pickerel *Esox niger*, white perch *Morone americana*, American eel *Anguilla rostrata*, common carp *Cyprinus carpio*, largemouth bass *Micropterus salmoides*, rock bass *Ambloplites rupestris*, black crappie *Pomoxis nigromaculatus*, and American shad *Alosa sapidissima* were collected. The edible fillets of individual fish were analyzed for metals, PCB and other organics and percent lipids. A total of five composite samples (each comprised of like-sized individuals of one species) collected at three of the four stations were also analyzed. These data were also provided to MA DPH for review. The 1988 survey resulted in the MA DPH modifying their advisory to include both American eel and yellow perch (MA DPH 1999).

The most recent MA DPH Fish Consumption Advisory List for the Connecticut River recommends the following (MA DPH 1999):

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Connecticut River (all towns between Northfield and Longmeadow), and
2. The general public should not consume channel catfish, white catfish, American eel, or yellow perch from the Connecticut River (all towns between Northfield and Longmeadow).

CURRENT INVESTIGATIONS

A work plan for *Fish Tissue Testing in the Connecticut River* was developed by the Connecticut River Forum in 1999. This project is currently being managed by the New England Interstate Water Pollution Control Commission (NEIWPCC) and the United States Environmental Protection Agency New England Regional Laboratory (US EPA NERL). A summary of this project and its study objectives are presented below (Card and Dakin 2000):

Connecticut River fish tissue contaminants, most notably PCB's and mercury, are detectable in certain fish species at levels resulting in State public health issued fish consumption advisories in New Hampshire, Vermont, Massachusetts and Connecticut. Fish contamination poses a special challenge for the states' public health authorities: how to manage such a risk while keeping the public informed through appropriate fish consumption advisories. In areas throughout the four states that comprise the Connecticut River watershed, public health authorities have issued advisories on the potential long-term health risks associated with eating certain quantities and types of fish.

The fish advisories were based on independent data collected by each State using its own methods for targeting fish species, fish collection, sample preparation, and analytical laboratories. Similar to most interstate river data, the Connecticut River fish tissue contaminant data are usually not comparable. Further, most of these data are at least ten years old. As a result, questions as to whether contamination levels are better or worse today, or whether the levels of contamination are higher in the same fish species in different reaches of the river cannot be answered.

The Connecticut River Forum first began collecting information about water quality roughly three years ago. Prior to this, there was little effort to coordinate the review of water quality information throughout the four-state river system. The Forum issued a report in 1998 with a series of recommendations to improve the management of the River. Improving water quality monitoring collaboration was a key recommendation in this report. The need for a collaborative fish tissue contaminant survey was chosen to be the first of several collaborative monitoring efforts on which the four States agreed to work.

At the June 16, 1998 meeting of the Connecticut River Forum, a sub-committee of technical individuals was established to assist in the design of a four-state comprehensive fish tissue monitoring program in the Connecticut River. The purposes of this study are to:

1. Determine if the fish are safe for human consumption.
2. Establish an adequate data set for comparative use in five or ten years when other fish tissue contaminant work might be cooperatively performed again to determine if the levels of PCB's and mercury are changing in the Connecticut River.
3. Enable public health officials to update fish consumption advisories.
4. Enable fish and wildlife ecologists to evaluate the ecological risks of fish tissue contamination.
5. Develop a study that includes comparable sampling, handling, preparation, and analytical methods.
6. Demonstrate the ability of the Connecticut River Forum to perform collaborative interstate monitoring.

The objective of the fish tissue study is to perform a watershed-wide fish tissue monitoring program which would document current conditions with regard to contaminant concentrations of representative fishes from the mainstem of the Connecticut River. In addition, the monitoring program would allow for

subsequent sampling at regular intervals to monitor trends in Connecticut River fish tissue contaminant concentrations.

Necessary information will be obtained to revise human health risk assessments for the Connecticut River. In addition, sufficient data with reliable quality assurance/quality control will be collected so that statistical comparison of concentrations seen in 2000 can be made to data collected in the future.

The program will contain the following elements:

1. Representative sites chosen by, and located within, each of the states participating in the project (site locations will be well distributed spatially and will also take into consideration major hydrologic features such as dams and tributaries).
2. Standard protocols for sample handling, sample preparation, and analytical methods.
3. As consistent a sample type among stations as possible (species, age or size, number in composite).
4. All sampling will be conducted within as small a time frame as possible.

Additional details on this project (field sampling initiated in July 2000) are available from either NEIWPCC or EPA (Card and Dakin 2000).

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APPENDIX C -- NPDES TABLES

National Pollutant Discharge and Elimination System (NPDES) permits are issued jointly by EPA and the Massachusetts DEP to facilities that discharge into surface waters. According to the MA DEP Division of Watershed Management (DWM) Surface Water Discharge Permit Program, there are generally three types of NPDES facilities Connecticut River Basin (Hogan 2000). These include municipal, institutional and industrial wastewater treatment plants (Table C1), power plants (Table C2) and aquaculture and fish hatcheries (Table C3). Permitting information for these facilities is provided in the following tables.

Table C1. Connecticut River Basin - Municipal, Institutional & Industrial WWTPs

Permittee	**NPDES #**	**Date of Permit Issuance**	**Permitted Flow (MGD)**	**Type of Treatment**	**Special Conditions for next permit**	**Available Dilution (7Q10 of river in cfs)**
Northfield	MA0100200	9/29/95	0.275	Secondary	-	1517
Montague	MA0100137	9/29/95	1.8	Secondary	CSO/IPT	1675
South Deerfield	MA0101648	9/29/95	0.85	Secondary	-	1687
Sunderland	MA0101079	9/29/95	0.5	Secondary	-	1687
Amherst	MA0100218		7.1	Secondary	-	1692
Hatfield	MA0101290	9/29/95	0.5	Secondary	-	1692
Hadley	MA0100099	9/29/95	0.54	Secondary	-	1711
Northampton	MA0101818	9/29/95	8.6	Secondary	IPT	1725
Easthampton	MA0101478	9/29/95	3.8	Secondary	IPT	1757
Belchertown	MA0102148	7/11/97	1.0	Advanced	TP/NH-3N	0.1
South Hadley	MA0100455	10/10/95	4.2	Secondary	CSO/IPT	1770
Holyoke	MA0101630	9/29/95	17.5	Secondary	CSO/IPT	1775
Chicopee	MA0101508	9/29/95	15.5	Secondary	CSO/IPT	1891
West Springfield	MA0101389	9/28/95	NA	Separate CSO	Will eliminate	NA
Springfield	MA0101613	9/29/95	67.0	Secondary	CSO/IPT	1975
Springfield	MA0103331	9/29/95	NA	CSO	CSO	NA
Agawam	MA0101320	9/29/95	NA	Separate CSO	Will eliminate	NA
Northfield-Mt. Hermon School	MA0032573	9/29/95	0.45	Secondary	-	1517
Esleek Mfg.	MA0005011	New permit in 2000	0.64	Microscreens	-	1675

Note:
1. secondary treatment (BOD/TSS = 30 mg/l monthly average; no metals or ammonia limits)
2. CSO = combined sewer overflows; also nine minimum controls implemented and long-term control strategy being ~~developed~~/developed/implemented
3. IPT = industrial pre-treatment program required as part of NPDES permit
4. D.F. = dilution factor = effluent flow + 7Q10 flow/ effluent flow
5. Belchertown WWTP discharges to Lampson Brook
6. West Springfield and Agawam permits will be withdrawn in 2000; Montague, South Deerfield, Amherst, Belchertown, Holyoke & Springfield permits will be reissued by 9/30/2000

Table C2. Connecticut River Watershed- Power Plant Facilities

Permittee	NPDES #	Date of Permit Issuance	Permitted Flow (MGD)	Generation Type	Type discharge/ special conditions	Receiving Water
Northfield Mountain Station	MA0035530	9/30/96	NA	Pump storage/ hydro	Misc. operational flows	Connecticut
Cabot Station	MA0035521	9/30/96	NA	hydro	Misc. operational flows	Connecticut
Mt. Tom	MA0005339	9/18/92	133.2 monthly avg.	coal	Condenser cooling; wastewater treatment	Connecticut
Holyoke Water Power	MA0035564 MA0035882 MA0035866 MA0035874	9/30/96	NA	hydro	Bearing cooling water; flood water pumps; sump pumps	Holyoke Canal/ Connecticut
West Springfield	MA0004707	9/26/88	***	Coal/oil	Condenser cooling/ wastewater treatment	Connecticut
UMass-Amherst Coal Pile	MA0032689	7/28/94	NA	NA	Storm water treatment of runoff from coal pile	Taylor Brook
Holyoke Gas & Electric	MA0001520	9/9/88	10.8 monthly avg.	Gas/oil/	Condenser cooling water	Holyoke Canal/ Connecticut

Table C3. Connecticut River Watershed: Aquaculture and Fish Hatcheries

Permittee	NPDES #	Permitted Flow (MGD	Type of Treatment	Special Conditions	Receiving Water	Town
Aqua Partners Technologies, LLC	MA0110264	0.5 monthly average	Biological/ ozonation	BMP plan	Connecticut	Montague
Bioshelters	MA0110281	0.086 maximum daily	Biological/ ozonation	BMP plan	Mill River	Amherst
Sunderland National Salmon Station	MA0110191	0.72 monthly average	Settling	NA	Mill River tributary	Sunderland
Sunderland State Hatchery	MA0110035	1.0 monthly average	Stabilization/ settling ponds	BMP plan	Russellville Brook	Sunderland
Red Wing Meadow Farm	MA0027880	1.44 monthly average	Settling ponds	BMP plan	Saw Mill River	Montague
Bitzer Trout Hatchery	MA0110051	1.1 monthly average	Settling Ponds	BMP plan	Connecticut tributary	Montague

REFERENCE

Hogan, P. 2000. Personal Communication. *Connecticut River Basin: permitting information.* Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management, Worcester, MA.

APPENDIX D--1998-99 CONNECTICUT RIVER NUTRIENT LOADING

Technical Memorandum, CN# 57.0

To: Arthur Johnson
Rick McVoy, Ph.D.
Laurie Kennedy
Mollie Weinstein
Cc: Russell Isaac, Ph.D.
From: Thomas Dallaire, Acting QAQC Officer
RE: 1998-99 Connecticut River Nutrient Loading project
CN#: 57.0

Date: November 3, 2000

The purpose of this technical memorandum is to document the analysis and results of water quality samples collected as part of the "1998-99 Connecticut River Nutrient Loading" project. At the time of this writing, the project is ongoing and therefore has not provided a final citable document.

Project Coordinator: Russell Isaac, Ph.D.
MA DEP/DWM – Worcester
627 Main St., 2nd Floor
Worcester, MA 01608

Project Objective: Quantify nitrogen loading to and from the Connecticut River

As of November 3rd, 2000 the water sample data had been entered into the DWM database management system and reviewed by the DWM QAQC Officer (MA DEP 2000). Finalization of data requires that the project coordinator, in consultation with the QAQC officer, reviews data for consistency and addresses any problems or aberrant trends noted by the QAQC officer. On November 3rd, 2000 Russell Isaac and Thomas Dallaire met to discuss consistency of the data with project objectives as well as address problems and aberrant trends identified (MA DEP 2000). It was agreed that the data were consistent with project objectives and that aberrant trends could be explained by known environmental factors; therefore, no additional censoring recommendations were offered.

SAMPLING STATIONS:

WESTFIELD RIVER
Station: CT02, Mile Point: 2.2
Description: off the downstream/east side of the Route 147 Bridge, Agawam/West Springfield.

DEERFIELD RIVER
Station: CT04, Mile Point: 1.1
Description: off the downstream/east side of the Route 5/10 Bridge, Deerfield/Greenfield.

CONNECTICUT RIVER
Station: CT06, Mile Point: 62.2
Description: off the upstream/northern side of the Route 10 Bridge, Northfield.

CONNECTICUT RIVER
Station: CT01, Mile Point: -1.9
Description: Off the upstream/north side of the Route 190 Bridge Enfield/Suffield.

MILLERS RIVER
Station: CT05, Mile Point: 1.7
Description: Off the upstream/east side of the Route 63 Bridge Erving/Montague.

CHICOPEE RIVER
Station: CT03, Mile Point: 0.8
Description: Off the upstream/east side of the Route 116 Bridge Chicopee.

QA/QC REPORT

INTRODUCTION

Quality Assurance/Quality Control (QA/QC) activities and review were conducted as part of the MA DEP DWM "1998-99 Connecticut River Nutrient Loading" project. The QA/QC review was conducted to ensure that the collection and analysis of monitoring data followed approved standard operating procedures (SOPs) and that data collected met data quality objectives (DQO's). All discrete water sample data were reviewed independently by the Wall Experiment Station's (WES) Quality Assurance Program, the Division of Watershed Management's (DWM) Quality Assurance Officer, Assessment Coordinator, and the DWM database manager. Data that fell outside established QA/QC acceptance criteria were investigated and may have been subject to censoring.

FIELD AND LABORATORY QA/QC OBJECTIVES

Data collected by DWM as part of the "1998-99 Connecticut River Nutrient Loading" project were subject to field and laboratory data quality objectives. Laboratory quality objectives are presented in the*1998 QA/QC Assessment Report* (MA DEP 2000).

DISCRETE WATER SAMPLE DATA

FIELD

A detailed QA/QC assessment of the four data quality objectives and additional DWM quality assurance observations for the "1998-99 Connecticut River Nutrient Loading" project data can be found in the 1998 QA/QC Assessment Report (MA DEP 2000).

The collection of discrete water samples followed DWM Standard Operating Procedures (MA DEP 1999). Four field collection quality control criteria were applied to the 1998-99 Connecticut River Nutrient Loading project discrete water sample data:

1.0 Sampling/Analysis Holding Time: Each analyte has a standard holding time that has been established to ensure sample/analysis integrity. Refer to DWM Standard Operating Procedure Table 1.0 CN# 1.0 (MA DEP 1999) for a complete listing. If the standard holding time was exceeded, this objective was violated and data are censored.

2.0 Quality Control Sample Frequency: At a minimum, one field blank and one replicate must be collected for every ten samples by any given sampling crew on any given date. If less than one quality control sample per 10 field samples was collected, this objective was violated.

3.0 Field Blank: Field blanks were prepared at the DWM Worcester Laboratory. Reagent grade water was transported into the field in a sample container where it was transferred into a different sample container and fixed where necessary using the same method as its corresponding field sample. All blanks were submitted to the WES laboratory "blind". If the field blanks were significantly different (>2 standard deviations (Clesceri *et al*. 1998)) from the detection limit, this data quality objective was violated.

4.0 Field Replicate: A discrete water sample was collected in a bucket with care taken to prevent settling of solids. Two samples (split samples) were then taken from the bucket and submitted to WES laboratory "blind". In order for this data quality objective to be met, the results must be:

<20% Relative Percent Difference (RPD) for method detection limits >1mg/L
<30% RPD for method detection limits <1mg/L

LABORATORY

Discrete water sample analysis followed EPA-approved laboratory QA/QC methodologies in accordance with WES Standard Operating Procedures (MA DEP 1995). The quality of data generated at WES was determined by analyzing the results of a variety of quality control procedures including but not limited to:

Low Calibration Standards – Checks the stability of the instrument's calibration curve. Analyzes the accuracy of an instrument's calibration within a 5% range.

Reference Standards – Generally, a second source standard (a standard different from the calibration stock standard) that analyzes the accuracy of an instrument's calibration within a 5% range.

Laboratory Reagent Blank/Method Blank (LRB) – Reagent grade water (de-ionized) is extracted with every sample set to ensure that the system is free of target analytes (< MDL).

Duplicate Sample – Measures the precision (% Relative Percent Difference) of the extraction and analytical process. The acceptable laboratory % RPD range is typically $\leq$ 25%.

Spike Sample (Laboratory Fortified Blank - LFB, Laboratory Fortified Matrix - LFM)– Measures the accuracy (% Recovery) of an analytical method. The acceptable laboratory % recovery range is typically between 80 – 120% for LFB samples and 70 –130% for LFM water samples.

The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. The frequency of the laboratory's quality control procedure was at times inconsistent with their Quality Assurance Plan (MA DEP 1995). In these circumstances additional quality assurance procedures were used. Refer to WES's Quality Assurance Plan (MA DEP 1995) for specific laboratory analytical QA/QC criteria. WES laboratory releases discrete water sample data when their established QA/QC criteria are met. Any data are released are outside of these criteria are labeled accordingly.

REFERENCES

Clesceri, L.S., A.E. Greenberg, and A.D. Eaton, (editors). 1998. *Standard Methods for the Examination of Water and Wastewater 20th Edition*. American Public Health Association, Washington, D.C.

MA DEP. 1995, January Draft. *Laboratory Quality Assurance Plan and Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis, Senator William X. Wall Experiment Station. Lawrence, MA.

MA DEP. 1999. CN 1.0 *Grab Collection Techniques for DWM Water Quality Sampling, Standard Operating Procedure*. October 25, 1999. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2000. CN 11.0 *1998 QA/QC Assessment Report*. 2000. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

QA/QC DATA

Field blank and field replicate sampling results for the discrete water quality sampling. MA DEP DWM QA/QC water quality data are managed and maintained in the *Water Quality Data Access Database*.

Table D1. 1998-99 Connecticut River Nutrient Loading project QA/QC field blank data. (All units expressed in mg/L unless otherwise specified.)

			Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
Field Blank Sample									
34-0008	BLANK	06/30/98	12:00	--	--	--	<0.02	<0.02	<0.01
34-0016	BLANK	07/28/98	14:00	--	<1.0	--	<0.02	<0.02	<0.01
34-0025	BLANK	08/26/98	12:05	--	<1.0	--	<0.02	<0.02	<0.01
34-0033	BLANK	09/23/98	11:43	--	<1.0	--	<0.02	<0.02	0.01
34-0041	BLANK	10/20/98	11:58	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0049	BLANK	11/17/98	12:10	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0057	BLANK	12/14/98	11:45	<2.0	<0.5	<0.10	<0.02	<0.02	<0.01
34-0065	BLANK	01/11/99	12:50	<2.0	<0.5	<0.10	<0.02	0.02	0.01
34-0073	BLANK	02/09/99	11:55	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0081	BLANK	03/10/99	12:35	<2.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0089	BLANK	03/23/99	12:45	<1.0	<0.5	<0.10	<0.02	<0.02	<0.01
34-0097	BLANK	04/06/99	11:55	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0105	BLANK	04/21/99	11:55	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01
34-0113	BLANK	05/12/99	12:00	<1.0	<1.0	<0.10	<0.02	<0.02	<0.01

-- = no data

Table D2. 1998-99 Connecticut River Nutrient Loading project instream physico-chemical QA/QC field replicate data. (All units expressed in mg/L unless otherwise specified.)

			Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
CONNECTICUT RIVER, Station: CT06									
34-0006	34-0007	06/30/98	12:00	--	--	--	<0.02	0.14	0.11
34-0007	34-0006	06/30/98	12:00	--	--	--	<0.02	0.14	0.13
Relative Percent Difference (RPD):							*0.0%*	*0.0%*	*16.7%*
34-0014	34-0015	07/28/98	14:00	--	<1.0	--	<0.02	0.18	<0.01
34-0015	34-0014	07/28/98	14:00	--	<1.0	--	<0.02	0.18	<0.01
Relative Percent Difference (RPD):					*0.0%*		*0.0%*	*0.0%*	*0.0%*
34-0023	34-0024	08/26/98	12:05	--	1.2	--	<0.02	0.18	0.01
34-0024	34-0023	08/26/98	12:05	--	1.2	--	<0.02	0.18	0.02
Relative Percent Difference (RPD):					*0.0%*		*0.0%*	*0.0%*	*66.7%*
34-0031	34-0032	09/23/98	11:43	--	<1.0	--	<0.02	0.20	0.02
34-0032	34-0031	09/23/98	11:43	--	<1.0	--	<0.02	0.22	0.02
Relative Percent Difference (RPD):					*0.0%*		*0.0%*	*9.5%*	*0.0%*
34-0039	34-0040	10/20/98	11:58	9.0	1.2	0.18	<0.02	0.19	0.02
34-0040	34-0039	10/20/98	11:58	9.0	1.2	0.17	<0.02	0.19	0.02
Relative Percent Difference (RPD):				*0.0%*	*0.0%*	*5.7%*	*0.0%*	*0.0%*	*0.0%*
34-0047	34-0048	11/17/98	12:10	11	1.0	0.13	<0.02	0.25	0.02
34-0048	34-0047	11/17/98	12:10	11	<1.0	0.12	<0.02	0.24	0.02
Relative Percent Difference (RPD):				*0.0%*	*0.0%*	*8.0%*	*0.0%*	*4.1%*	*0.0%*
34-0055	34-0056	12/14/98	11:45	6.0	1.8	0.17	<0.02	0.29	0.02
34-0056	34-0055	12/14/98	11:45	7.0	1.9	0.15	<0.02	0.28	0.02
Relative Percent Difference (RPD):				*15.4%*	*5.4%*	*12.5%*	*0.0%*	*3.5%*	*0.0%*
34-0063	34-0064	01/11/99	12:50	10	0.8	0.18	0.02	0.38	0.02
34-0064	34-0063	01/11/99	12:50	11	0.6	0.18	0.02	0.39	0.02
Relative Percent Difference (RPD):				*9.5%*	*28.6%*	*0.0%*	*0.0%*	*2.6%*	*0.0%*
34-0071	34-0072	02/09/99	11:55	13	1.1	0.15	0.02	0.33	0.02
34-0072	34-0071	02/09/99	11:55	12	0.9	0.16	<0.02	0.32	0.02
Relative Percent Difference (RPD):				*8.0%*	*20.0%*	*6.5%*	*0.0%*	*3.1%*	*0.0%*
34-0079	34-0080	03/10/99	12:35	11	4.1	0.17	<0.02	0.29	0.03
34-0080	34-0079	03/10/99	12:35	12	3.9	0.22	<0.02	0.29	0.03
Relative Percent Difference (RPD):				*8.7%*	*5.0%*	*25.6%*	*0.0%*	*0.0%*	*0.0%*
34-0087	34-0088	03/23/99	12:45	9.0	110	0.56	0.03	0.26	0.25
34-0088	34-0087	03/23/99	12:45	9.0	130	0.56	0.02	0.26	0.26
Relative Percent Difference (RPD):				*0.0%*	*16.7%*	*0.0%*	*40.0%*	*0.0%*	*3.9%*
34-0095	34-0096	04/06/99	11:55	5.0	43	0.24	<0.02	0.33	0.07
34-0096	34-0095	04/06/99	11:55	5.0	45	0.27	<0.02	0.32	0.06
Relative Percent Difference (RPD):				*0.0%*	*4.5%*	*11.8%*	*0.0%*	*3.1%*	*15.4%*
34-0103	34-0104	04/21/99	11:55	7.0	1.9	0.11	<0.02	0.31	0.02
34-0104	34-0103	04/21/99	11:55	7.0	1.6	0.15	<0.02	0.31	0.02
Relative Percent Difference (RPD):				*0.0%*	*17.1%*	*30.8%*	*0.0%*	*0.0%*	*0.0%*
34-0111	34-0112	05/12/99	12:00	7.0	1.0	0.15	<0.02	0.24	0.01
34-0112	34-0111	05/12/99	12:00	7.0	<1.0	0.16	<0.02	0.23	0.01
Relative Percent Difference (RPD):				*0.0%*	*0.0%*	*6.5%*	*0.0%*	*4.3%*	*0.0%*

-- = no data

ANALYTICAL METHODS

Discrete Water Sample Analytes	EPA Method*	SM Methods**
Chloride (4500)		SM 4500CL-B
Ammonia-N	EPA 350.1	
Nitrate/Nitrite-N	EPA 353.1	
Kjeldahl-N	EPA 351.2	
Phosphorus-P (MAN)		SM 4500P-E
Suspended Solids		SM 2540D

* = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.

** = Standard Methods for the Examination of Water and Wastewater, 20th edition

Table D3. 1998-99 Connecticut River Nutrient Loading project, instream physico/chemical data. All units in mg/L unless otherwise noted.

		Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
WESTFIELD RIVER								
Station: CT02, Mile Point: 2.2								
Description: off the downstream/east side of the Route 147 bridge, Agawam/West Springfield. Center stream bucket drop.								
34-0002	06/30/98	9:15	--	--	--	0.07	0.30	0.05
34-0010	07/28/98	9:30	--	<1.0	--	0.03	0.68	0.04
34-0019	08/26/98	8:45	--	3.8	--	0.09	1.0	0.11
34-0027	09/23/98	8:55	--	1.4	--	0.06	1.1	0.13
34-0035	10/20/98	9:30	14	1.0	0.24	0.06	0.51	0.07
34-0043	11/17/98	9:17	17	1.3	0.32	0.17	0.61	0.07
34-0051	12/14/98	9:30	16	0.8	0.30	0.17	0.62	0.07
34-0059	01/11/99	9:35	48	1.1	0.38	0.18	0.48	0.04
34-0067	02/09/99	9:35	16	1.6	0.29	0.15	0.46	0.04
34-0075	03/10/99	9:10	9.0	1.7	0.21	0.11	0.46	0.04
34-0083	03/23/99	9:40	8.0	21	0.26	0.02	0.21	0.07
34-0091	04/06/99	9:30	10	1.7	0.17	0.07	0.28	0.03
34-0099	04/21/99	9:25	11	1.1	0.25	0.09	0.33	0.04
34-0107	05/12/99	9:35	10	1.7	0.23	0.11	0.25	0.05
DEERFIELD RIVER								
Station: CT04, Mile Point: 1.1								
Description: off the downstream/east side of the Route 5/10 bridge, Deerfield/Greenfield. Center stream bucket drop.								
34-0004	06/30/98	10:55	--	--	--	<0.02	0.20	0.02
34-0012	07/28/98	12:45	--	1.2	--	0.07	0.30	0.04
34-0017	07/28/98	12:48	--	26	--	0.08	0.29	0.11
34-0021	08/26/98	10:17	--	--	--	<0.02	0.18	0.02
34-0029	09/23/98	11:00	--	<1.0	--	0.06	0.28	0.05
34-0037	10/20/98	11:15	7.0	<1.0	0.19	0.03	0.15	0.04
34-0045	11/17/98	11:25	9.0	3.1	0.24	0.08	0.23	0.05
34-0053	12/14/98	11:10	6.0	1.3	0.18	0.03	0.19	0.03
34-0061	01/11/99	11:40	13	2.4	0.22	0.06	0.29	0.02
34-0069	02/09/99	11:10	8.0	3.2	0.17	<0.02	0.26	0.02
34-0077	03/10/99	11:50	9.0	2.8	0.12	<0.02	0.27	0.02
34-0085	03/23/99	12:00	6.0	36	0.21	<0.02	0.22	0.06
34-0093	04/06/99	11:10	5.0	2.0	<0.10	<0.02	0.17	0.02
34-0101	04/21/99	11:05	7.0	<1.0	0.21	0.08	0.24	0.03
34-0109	05/12/99	11:15	7.0	1.1	0.21	0.08	0.16	0.03

** = missing/censored data -- = no data

Table D3. Continued. 1998-99 Connecticut River Nutrient Loading project, instream physico/chemical data. All units in mg/L unless otherwise noted.

			Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
CONNECTICUT RIVER									
Station: CT06, Mile Point: 62.2									
Description: off the upstream/northern side of the Route 10 bridge, Northfield. Center stream bucket drop.									
34-0006	34-0007	06/30/98	12:00	--	--	--	<0.02	0.14	0.11
34-0007	34-0006	06/30/98	12:00	--	--	--	<0.02	0.14	0.13
34-0014	34-0015	07/28/98	14:00	--	<1.0	--	<0.02	0.18	<0.01
34-0015	34-0014	07/28/98	14:00	--	<1.0	--	<0.02	0.18	<0.01
34-0023	34-0024	08/26/98	12:05	--	1.2	--	<0.02	0.18	0.01
34-0024	34-0023	08/26/98	12:05	--	1.2	--	<0.02	0.18	0.02
34-0031	34-0032	09/23/98	11:43	--	<1.0	--	<0.02	0.20	0.02
34-0032	34-0031	09/23/98	11:43	--	<1.0	--	<0.02	0.22	0.02
34-0039	34-0040	10/20/98	11:58	9.0	1.2	0.18	<0.02	0.19	0.02
34-0040	34-0039	10/20/98	11:58	9.0	1.2	0.17	<0.02	0.19	0.02
34-0047	34-0048	11/17/98	12:10	11	1.0	0.13	<0.02	0.25	0.02
34-0048	34-0047	11/17/98	12:10	11	<1.0	0.12	<0.02	0.24	0.02
34-0055	34-0056	12/14/98	11:45	6.0	1.8	0.17	<0.02	0.29	0.02
34-0056	34-0055	12/14/98	11:45	7.0	1.9	0.15	<0.02	0.28	0.02
34-0063	34-0064	01/11/99	12:50	10	0.8	0.18	0.02	0.38	0.02
34-0064	34-0063	01/11/99	12:50	11	0.6	0.18	0.02	0.39	0.02
34-0071	34-0072	02/09/99	11:55	13	1.1	0.15	0.02	0.33	0.02
34-0072	34-0071	02/09/99	11:55	12	0.9	0.16	<0.02	0.32	0.02
34-0079	34-0080	03/10/99	12:35	11	4.1	0.17	<0.02	0.29	0.03
34-0080	34-0079	03/10/99	12:35	12	3.9	0.22	<0.02	0.29	0.03
34-0087	34-0088	03/23/99	12:45	9.0	110	0.56	0.03	0.26	0.25
34-0088	34-0087	03/23/99	12:45	9.0	130	0.56	0.02	0.26	0.26
34-0095	34-0096	04/06/99	11:55	5.0	43	0.24	<0.02	0.33	0.07
34-0096	34-0095	04/06/99	11:55	5.0	45	0.27	<0.02	0.32	0.06
34-0103	34-0104	04/21/99	11:55	7.0	1.9	0.11	<0.02	0.31	0.02
34-0104	34-0103	04/21/99	11:55	7.0	1.6	0.15	<0.02	0.31	0.02
34-0111	34-0112	05/12/99	12:00	7.0	1.0	0.15	<0.02	0.24	0.01
34-0112	34-0111	05/12/99	12:00	7.0	<1.0	0.16	<0.02	0.23	0.01

** = missing/censored data -- = no data

Table D3. Continued. 1998-99 Connecticut River Nutrient Loading project, instream physico/chemical data. All units in mg/L unless otherwise noted.

		Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
CONNECTICUT RIVER								
Station: CT01, Mile Point: -1.9								
Description: off the upstream/north side of the Route 190 bridge Enfield/Suffield, Connecticut. Center stream long bucket drop. (The point in Arcview is as close as MA state coverage allows, actual point is further downstream/south.)								
34-0001	06/30/98	8:45	--	--	--	0.03	0.17	0.25
34-0009	07/28/98	8:45	--	<1.0	--	0.02	0.26	0.02
34-0018	08/26/98	8:15	--	2.2	--	0.04	0.33	0.04
34-0026	09/23/98	9:25	--	<1.0	--	0.10	0.41	0.10
34-0034	10/20/98	8:55	11	1.4	0.20	0.03	0.30	0.06
34-0042	11/17/98	8:45	13	1.1	0.24	0.04	0.34	0.06
34-0050	12/14/98	8:55	8.0	0.8	0.24	0.05	0.34	0.03
34-0058	01/11/99	9:00	30	1.1	0.31	0.09	0.52	0.05
34-0066	02/09/99	9:00	16	2.6	0.27	0.05	0.34	0.03
34-0074	03/10/99	8:45	12	7.3	0.23	0.02	0.31	0.05
34-0082	03/23/99	9:00	10	180	0.93	0.05	0.30	0.34
34-0090	04/06/99	9:00	6.0	50	0.20	0.02	0.30	0.08
34-0098	04/21/99	9:00	9.0	2.9	0.19	0.04	0.36	0.04
34-0106	05/12/99	9:10	9.0	2.1	0.19	0.08	0.33	0.03
MILLERS RIVER								
Station: CT05, Mile Point: 1.7								
Description: off the upstream/east side of the Route 63 bridge, Erving/Montague. Center stream bucket drop.								
34-0005	06/30/98	11:30	--	--	--	<0.02	0.20	0.06
34-0013	07/28/98	13:30	--	1.0	--	<0.02	0.21	0.04
34-0022	08/26/98	11:35	--	0.4	--	<0.02	0.53	0.04
34-0030	09/23/98	11:21	--	2.4	--	0.04	0.83	0.07
34-0038	10/20/98	11:35	25	**	0.35	<0.02	0.31	0.06
34-0046	11/17/98	11:45	31	1.8	0.28	<0.02	0.59	0.06
34-0054	12/14/98	11:25	24	1.7	0.32	0.03	0.55	0.06
34-0062	01/11/99	12:25	66	1.8	0.56	0.15	0.42	0.05
34-0070	02/09/99	11:30	22	2.0	0.27	0.02	0.18	0.03
34-0078	03/10/99	12:15	21	2.3	0.27	<0.02	0.15	0.03
34-0086	03/23/99	12:20	13	4.0	0.20	<0.02	0.10	0.03
34-0094	04/06/99	11:30	20	1.1	0.17	<0.02	0.13	0.25
34-0102	04/21/99	11:30	24	1.7	0.81	<0.02	0.18	0.03
34-0110	05/12/99	11:40	28	3.3	0.34	<0.02	0.34	0.06

** = missing/censored data -- = no data

Table D3. Continued. 1998-99 Connecticut River Nutrient Loading project, instream physico/chemical data. All units in mg/L unless otherwise noted.

		Time (24hr)	Chloride	Suspended Solids	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
CHICOPEE RIVER								
Station: CT03, Mile Point: 0.8								
Description: off the upstream/east side of the Route 116 bridge, Chicopee. Center stream bucket drop.								
34-0003	06/30/98	9:45	--	--	--	0.04	0.24	0.06
34-0011	07/28/98	10:05	--	1.0	--	<0.02	0.33	0.04
34-0020	08/26/98	9:30	--	--	--	0.02	0.35	0.04
34-0028	09/23/98	9:55	--	6.6	--	0.06	0.40	0.07
34-0036	10/20/98	10:05	17	1.6	0.29	<0.02	0.27	0.05
34-0044	11/17/98	9:50	24	7.0	0.41	<0.02	0.37	0.06
34-0052	12/14/98	10:05	20	1.3	0.22	<0.02	0.46	0.04
34-0060	01/11/99	10:20	42	1.9	0.38	0.06	0.45	0.04
34-0068	02/09/99	10:15	15	1.6	0.29	0.02	0.26	0.03
34-0076	03/10/99	9:45	16	1.6	0.20	<0.02	0.19	0.03
34-0084	03/23/99	10:20	15	5.6	0.23	<0.02	0.22	0.05
34-0092	04/06/99	10:15	17	1.5	0.21	<0.02	0.20	0.03
34-0100	04/21/99	10:00	18	2.1	0.28	<0.02	0.25	0.03
34-0108	05/12/99	10:20	18	3.5	0.27	0.02	0.27	0.04

** = missing/censored data -- = no data

ERRATA SHEET (18 January 2001)
CONNECTICUT RIVER BASIN 1998 WATER QUALITY ASSESSMENT REPORT

Prepared by Laurie E. Kennedy and Mollie J. Weinstein in cooperation with Robert J. McCollum at the Department of Environmental Protection, Division of Watershed Management. Report Number 34-AC-1. DWM Control Number 45.0

Page i Table of Contents

Executive Summary listed in the TABLE OF CONTENTS as page ~~vi~~ should be listed as page v.

Page v Executive Summary

The end of first paragraph should read… under the Performance Partnership Agreement (PPA) and every two years as part of Section 305(b) of the Clean Water Act (CWA).

Page vi Executive Summary – Recreational Uses – Rivers

The status should be corrected as follows:

Primary Contact Use Summary – Rivers

- 15.9 river miles ~~partial~~ non support
- 222.05 river miles not assessed

Secondary Contact Use Summary – Rivers

- 15.9 river miles ~~non~~ partial support
- 222.05 river miles not assessed

Page vii Executive Summary - Lakes

In the first paragraph second sentence should read …these data represent approximately ~~38~~ 41% (~~47~~ 51of 123) of the lakes/ponds in the Connecticut Basin and about ~~83~~ 84% (~~2,770~~ 2,803 of 3,342) of the acreage.

Page vii and ix Executive Summary - Aquatic Life - Lakes and Summary - Lakes

The first paragraph should read ….Despite the "best case" scenario that is favored by the Connecticut River Basin lake assessment approach, ~~49~~ 45% of the lakes showed severe (eutrophic or hypereutrophic) symptoms of succession (Table 2).

Page ix Executive Summary – Lakes Table 1

Corrected as follows:

Table 1. Connecticut River Basin Lakes Use Support Summary (In Acres).

USE	SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED	NOT ATTAINABLE
Aquatic Life	0	759.9	0	~~1872.5~~ 1905.5	138
Fish Consumption*	0	0	248	~~2384.4~~ 2417.4	138
Primary Contact	0	399.9	183	~~2049.5~~ 2082.5	138
Secondary Contact	1994.8	399.9	183	~~54.7~~ 87.7	138
Aesthetics	1994.8	399.9	183	~~54.7~~ 87.7	138

Page ix Executive Summary – Lakes Table 2

Corrected as follows:

Table 2. Connecticut River Basin Lakes Trophic Status Summary ~~surveyed in Summer, 1998.~~

TROPHIC STATUS	NUMBER OF LAKES	ACRES
Oligotrophic	0	0
Mesotrophic	0	0
Eutrophic	19	515.8
Hypereutrophic	4	104.5
Undetermined/ Not Attainable	~~24~~ 28	~~2150.1~~ 2183.1
Total	~~47~~ 51	~~2770.4~~ 2803.4

Page 13 Table 4 as it appears in the report

Table 4. 1998 303(d) list of impaired waters, Connecticut River Basin (MA DEP 1999a).

1998 303(d) Listed Waterbody		Cause of Impairment
Connecticut River	New Hampshire/Vermont state line to Route 10 bridge, Northfield	priority organics (PCB) and pathogens (fecal coliform bacteria)
	Route 10 bridge, Northfield to Turners Falls Dam, Montague	PCB
	Turners Falls Dam, Montague to confluence with Deerfield River, Greenfield	PCB
	Confluence with Deerfield River, Greenfield to Holyoke Dam, Holyoke	PCB, and fecal coliform bacteria
Weston Brook	Holyoke Dam, Holyoke to Connecticut state line, Longmeadow/Agawam	PCB, fecal coliform bacteria, and suspended solids
Lampson Brook	Headwaters Belchertown to inlet Forge Pond, Granby	unionized ammonia, chlorine, nutrients, organic enrichment/low DO, and fecal coliform bacteria
Arcadia Lake	Belchertown State Hospital WWTP to confluence with Weston Brook, Belchertown	unionized ammonia, chlorine, nutrients, and organic enrichment/low DO
Lake Bray	Belchertown	nutrients, and noxious aquatic plants
Forge Pond	Holyoke	noxious aquatic plants
Ingraham Brook Pond	Granby	nutrients and noxious aquatic plants
Leverett Pond	Granby	noxious aquatic plants
Loon Pond	Leverett	noxious aquatic plants and turbidity
Metacomet Lake	Springfield	nutrients and noxious aquatic plants
Nashawannuck Pond	Belchertown	organic enrichment/low DO
Venture Pond	Easthampton	nutrients, organic enrichment/low DO, and noxious aquatic plants
Lake Warner	Springfield	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Watershops Pond	Hadley	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Lake Wyola	Springfield	noxious aquatic plants
Aldrich Lake*	Shutesbury	noxious aquatic plants, organic enrichment/low DO, and nutrients
Aldrich Lake*	Granby	noxious aquatic plants

*needs confirmation (additional data connection is necessary to confirm the presence of impairment)

Table 4 should be corrected as follows:

Table 4. 1998 303(d) list of impaired waters, Connecticut River Basin (MA DEP 1999a).

1998 303(d) Listed Waterbody		Cause of Impairment
Connecticut River	New Hampshire/Vermont state line to Route 10 bridge, Northfield	priority organics (PCB) and pathogens (fecal coliform bacteria)
	Route 10 bridge, Northfield to Turners Falls Dam, Montague	PCB
	Turners Falls Dam, Montague to confluence with Deerfield River, Greenfield	PCB
	Confluence with Deerfield River, Greenfield to Holyoke Dam, Holyoke	PCB, and fecal coliform bacteria
~~**Weston Brook**~~ should be Connecticut River	Holyoke Dam, Holyoke to Connecticut state line, Longmeadow/Agawam	PCB, fecal coliform bacteria, and suspended solids
Weston Brook	Headwaters Belchertown to inlet Forge Pond, Granby	unionized ammonia, chlorine, nutrients, organic enrichment/low DO, and fecal coliform bacteria
Lampson Brook	Belchertown State Hospital WWTP to confluence with Weston Brook, Belchertown	unionized ammonia, chlorine, nutrients, and organic enrichment/low DO
Arcadia Lake	Belchertown	nutrients, and noxious aquatic plants
Lake Bray	Holyoke	noxious aquatic plants
Forge Pond	Granby	nutrients and noxious aquatic plants
Ingraham Brook Pond	Granby	noxious aquatic plants
Leverett Pond	Leverett	noxious aquatic plants and turbidity
Loon Pond	Springfield	nutrients and noxious aquatic plants
Metacomet Lake	Belchertown	organic enrichment/low DO
Nashawannuck Pond	Easthampton	nutrients, organic enrichment/low DO, and noxious aquatic plants
Venture Pond	Springfield	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Lake Warner	Hadley	nutrients, organic enrichment/low DO, noxious aquatic plants, and turbidity
Watershops Pond	Springfield	noxious aquatic plants
Lake Wyola	Shutesbury	noxious aquatic plants, organic enrichment/low DO, and nutrients
Aldrich Lake*	Granby	noxious aquatic plants
Aldrich Lake*	Granby	noxious aquatic plants
Upper Van Horn Park Pond**	Springfield	Nutrients, noxious aquatic plants

*needs confirmation (additional data connection is necessary to confirm the presence of impairment)

**mistakenly listed as being in the Chicopee River Basin in the 1998 303(d) list

Page 78 Stony Brook

Noted that the inset map is incorrect (Broad Brook instead of Stony Brook).

Page 83 Connecticut River Segment MA34-05

In the Chicopee WWTP paragraph, corrected …the average daily ~~**for**~~ discharge in 1999 was 9.33 MGD (McCollum 2000).

Page 84 Aquatic Life <u>Biology</u> paragraph

Corrected spelling ~~**endarged**~~ endangered and corrected reference at end of paragraph (~~**MA DEP 2000e**~~) (MA DEP 7 November 2000).

Pages 103 to 105 Table 10 Information Codes footer

The use attainment code U = Undetermined/not assessed

Page 108 Literature Cited

~~**MA DEP 7 November 2000e**~~ MA DEP. 7 November 2000.

Page 109 Literature Cited

Added Mill River Stream Team. 1999. *Draft Action Plan for the Mill River and its Tributaries*. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Riverways Program, Boston, MA.

APPENDIX C Page C1

Table C1 second note at end of table ~~**developed**~~/developed/implemented

APPENDIX D Page D1

SAMPLING STATIONS:

WESTFIELD RIVER
Station: CT02, Mile Point: 2.2
Description: off the downstream/east side of the Route 147 Bridge, Agawam/West Springfield.
DEERFIELD RIVER
Station: CT04, Mile Point: 1.1
Description: off the downstream/east side of the route 5/10 bridge, Deerfield/Greenfield.
CONNECTICUT RIVER
Station: CT06, Mile Point: 62.2
Description: off the upstream/northern side of the route 10 bridge, Northfield.
CONNECTICUT RIVER
Station: CT01, Mile Point: -1.9
Description: Off the upstream/north side of the Route 190 Bridge Enfield/Suffield.
MILLERS RIVER
Station: CT05, Mile Point: 1.7
Description: Off the upstream/east side of the Route 63 Bridge Erving/Montague.
CHICOPEE RIVER
Station: CT03, Mile Point: 0.8
Description: Off the upstream/east side of the Route 116 Bridge Chicopee.